OLUME XVIII DECEMBER, 1918 NUMBER

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CLARK WISSLER, OF THE AMERICAN MUSEUM, AUTHOR OF "THE AMERICAN INDIAN"

The following is quoted from a review of the book which appeared in the *American Anthropologist* (N. S. 20, 1918), by Professor A. L. Kroeber, of the University of California:

"Dr. Wissler has looked almost wholly for mass results: and he has got them in a degree that makes all previous efforts in the same direction seem feebly puny. In the power of practical organization displayed, the book is characteristically American.

The author evinces remarkable balance of judgment. . . . He looks into everything and faces any aspect impartially; if his conclusion comes out tentative, he is willing to have it so. He steers a mean course, equally clear from the Scylla of mere depiction and the Charybdis of theory spinning. The evolutionist, migrationist, and other snares that so regularly enmesh those with a weakness for deduction, never touch him. It is a pleasure to feel his apparently instinctive aversion to anything but inductive reference. . . . He has moved forward the science of anthropology. The book traverses a long route; and there is scarcely a point touched but something is established which before was vague or obscure or postponed or unorganized"

—See "Review of Wissler's *The American Indian*," page 646.

THE AMERICAN MUSEUM JOURNAL

VOLUME XVIII DECEMBER, 1918 NUMBER 8

The Food Supply of Our Allies

STORY OF HOW KNOWLEDGE OF THE AMOUNTS OF IMPORTED MEAT, FATS, SUGAR, AND CEREALS NEEDED DURING 1919 BY BRITAIN, FRANCE, AND ITALY, WAS SUPPLIED TO MR. HOOVER

By GRAHAM LUSK[1]

Professor of Physiology, Cornell Medical College, and Scientific Director of Russell Sage Institute of Pathology

ABOUT 1750, Benjamin Franklin observed in *Poor Richard's Almanac* that wherever there was famine there was disorder, and wherever there was disorder famine followed in its train. This has been the keynote of the present world situation. Lack of hygiene and sanitation does not cause disorder. Soldiers have lived incrusted in the mud of Flanders but have maintained their morale when well nourished. The Russian peasant is firmly convinced that the louse is necessary for health because this vermin leaves his body only in the event of his death. If cleanliness were as much desired by the people as food, then the streets of our cities would be kept in perfect order, and no dirt would be allowed to accumulate upon them. Indeed, Tolstoy teaches that the desire for cleanliness is a cultivated extravagance and not an instinctive impulse. The call for food is, however, insistent and instinctive and must be satisfied or social discontent arises.

The food situation of the Central Powers a year ago, so far as can be ascertained, was that because of the supplies they had obtained in Russia they were somewhat better off than they had been a year before. There are some indications that Germany believed that after the treaty with Russia there would be plenty of food for Germany. The supplies, however, proved disappointing because the vicious circle of disorder and famine had had its evil effect upon the Russian crop production. If time is spent in pillage and cheering the red flag, there is no labor to produce a crop, and if the farmer's crop is stolen from him, there is no incentive for him to raise one. Not only this, but the German conquerors had a first right to such crops as might be raised.

On account of the free access to the sea, the position of the Allied Powers, as regards the food factor, was superior to that of Germany, and yet here, too, were difficulties. The submarines in March, 1918, were sinking vessels faster than they could be built. Englishmen looking out to sea on the coast of Cornwall in southern England could frequently see ships go down with their precious cargoes of food on board. Furthermore, ships were needed for the transport of American troops and munitions to Europe. Everything was done to reorganize the situation. The

[1] Member of the Interallied Scientific Food Commission and American delegate, with Professor R. H. Chittenden, to the meetings of the Commission held in Paris, Rome, and London, in 1918, for the purpose of examining scientifically the interallied program for food supplies.

Shipping Board brought ships from all over the world, from the remote trade routes in the Pacific, and put them to work on the short line between Europe and America. The ships were no longer under orders from their owners, but an interallied board of men of genius and capacity directed whether a ship should go here or there in accordance with the situation. England, who owned most of the ships, did not have the deciding voice if Italy's need was at the moment predominant. Here, indeed, was interallied government control which could be effective only through the renunciation of many national rights in the interest of world welfare. The working out of such a scheme is prophetic of the success of a League of Nations. It was the same way with the food question. Theoretically at least, we were all pledged to eat at a common table in the interests of a common victory over the war lords of Berlin.

The beginning of the present year witnessed an effective propaganda on the part of Mr. Hoover's Food Administration for the saving of wheat on the part of the people of the United States. Our usual surplus carry-over of the summer before had all been exported, and our crop of 1917 was only just equal to the necessities of our own people, which amounts to an annual per capita consumption of five bushels or 500,000,000 for the whole country. Our own people had never worked so hard, they had never been so well paid, and the natural tendency was toward a larger consumption of all food materials. The response to the appeal was whole-hearted. Several of the southern states pledged themselves to eat no wheat until the next crop was harvested, and corn bread became the bread of every patriotic citizen. The supply of corn meal for this purpose is practically unlimited in America, since Indian corn is always our greatest crop, reaching in 1917 more than 3,000,000,000 bushels. Under ordinary circumstances only 6 per cent of the corn crop is used for human food. The rest is used as fodder for cattle. The number of pigs raised is quite proportional to the size of the corn crop, and in the spring of this year Mr. Hoover was able to offer to the Allies in one lot 450,000 tons of pork products. This single offer was sufficient to give an ounce of pork apiece to the 43,000,000 of the civilian population of Great Britain daily for a year and to provide about 20 per cent of its total requirement of fat. Such results were obtained by transforming the corn of our western states into fat pork, and by the fact that we gave up eating bacon and pork in order to save the material for our Allies.

At the beginning of the year, as we have seen, the Allies were threatened, first, by the submarine warfare; second, by our wheat crop shortage; and third, by the possible contingency of a second crop shortage which might eventuate in 1918. For that reason an Interallied Scientific Food Commission, which had been instituted by the Interallied Council at Versailles at the suggestion of Dr. Alonzo E. Taylor, was called together, Professor Chittenden and I sailing for Europe on February 6 to attend the meetings of the Commission.

It seemed strangely interesting to transfer one's thought from the behavior of food in individual dogs and sometimes in individual men, as I had been doing, to the consideration of the proper nutrition of 230,000,000 people in Great Britain, France, Italy, and the United States.

The Interallied Scientific Food Commission met in Paris the end of March; in Rome, the first of May; and in London, early in June. It was made up of two men from each country: Professors Gley and Langlois, of France; Starling and Wood, of Great Britain; Bottazzi and Pagliani, of Italy; and Chittenden and Lusk, of the United

States. The celebrated Professor Richet was a member at the opening meeting in Paris but was replaced by Langlois, and at the London meeting Pagliani was replaced by Menozzi.

Before the Commission was called together we had an opportunity to study the conditions as they existed in Britain. The Royal Society of London had established a Food Committee under the chairmanship of Starling, professor of physiology of the University of London. To this Committee came T. B. Wood, professor of agriculture in the University of Cambridge; Gowland Hopkins, of the same college; Noël Paton, of Glasgow; Halliburton, Hill, Sir Henry Thompson, Hardy, secretary of the Royal Society, and many others, all men whom we had known in happier years. This Committee had worked with great ability upon the various problems connected with the food situation, and their judgment had on various occasions determined the policy of the Ministry of Food under Lord Rhondda. It is only justice to say that the principles evolved by the Royal Society Food Committee were in their essence the fundamentals which the Interallied Scientific Food Commission adopted.

The food situation in Britain was quite different from that which existed before the war. Meat, fat, and sugar were all rationed, rich and poor alike receiving the same amounts. The quantities of these materials which were available were only one half their consumption before the war. The quantity of meat which was allowed to the civilian population of England and Scotland last winter was about the same in amount as that given to the inmates of the poorhouse in Helsingfors, Finland, in 1910. The quantity of fat in the diet was not far from the amount allowed in Voit's celebrated diet for a poor laboring man. The reduction in the quantities of meat, fat, and sugar amounted in value to the elimination from the diet list of one fifth of all the foods available before the war. To compensate for this, intensive gardening had produced a bountiful crop of potatoes, and artichokes had been grown in waste places to add to the food supply, but more than anything else, wheat from America added to the bread supply. The consumption of bread grains had risen from nine ounces per capita daily to nineteen ounces per capita.

Bread was not rationed, although plans were in readiness so that in case of necessity, that is in case the German submarine menace should actually become converted into an efficient blockade, it could have been rationed at a moment's notice. Fortunately, the British fleet held the sea, for Britain can raise at best only half enough food to support her population. It was the general political policy of the government to make bread freely available to all classes of the people. It was subsidized by the government so that flour, which could be made into bread, cost much less than corn, which was used for chicken feed. No one would eat to excess of the dark-colored war bread of which there was some complaint. Parenthetically it may be stated that there is always complaint about food, no matter what the condition of life. In general, food priority followed these lines: 1, the fighting forces; 2, the munition workers; 3, children.

We visited the Woolwich Arsenal, located in a fenced enclosure ten miles in circumference and employing 110,000 workers, of which 25,000 were women. The workers were fed in canteens managed and run by patriotic women. The food was good, plentiful and cheap, and the money paid for the food covered all overhead charges. Great ovens held piping hot potatoes, and vegetable pies were in high demand. The workmen preferred to share their meat rations with their families on Sundays and lived very

largely upon a vegetarian dietary. Of course, it was more difficult to satisfy the palate without meat, but since the worker knew that from the King down all were sharing in the same deprivation, there was no social discontent. Six canteens were managed by the workmen themselves, and these, we were told, were the least satisfactory of the establishments. We were shown one canteen in which 800 girls were given their food. This canteen was painted white inside and the girls wore rubber soled shoes when walking on the floor, their occupation precluding the introduction of a particle of gritty dirt into their shop.

Variety was not always obtainable, especially in the individual country home. A friend of mine had a farm in Sussex upon which lived sixteen farmers. His men complained that when they came home to dinner there was frequently nothing but bread to eat. When there is no meat at many of the meals and little butter or margarin, it is easy to see how bread alone could become distasteful. If one introduces bread through an artificial opening into the stomach of a sleeping dog he cannot digest it. Only after eating it with appetite does the gastric juice flow so that digestion takes place. So my friend sent to Scotland and bought 350 pounds of cheese and rationed it among the farmers at the rate of five pounds per month per family. This changed the condition of the men completely. An old proverb of the ancient medical school of Salerno reads, "No digestion without cheese." And Shakespeare makes one of his characters say to another,[1]

"Why, my cheese, my digestion, why hast thou not served thyself in to my table so many meals?"

Despite individual difficulties, it was the general consensus of opinion that the people of Great Britain had never been so well nourished as during last winter. The undernourishment of large masses of the people, such as existed before the war, had entirely disappeared. Children in London looked well fed. Wages were higher than they ever had been. It was the general feeling among those who had to do with the problem that an ample food supply must be provided for all the people in any policy of reconstruction after the war. By what process or plan this could be achieved I was never informed. It seems certain, however, that the peace and calm of Great Britain last spring were due to the food policy of her rulers. At night the darkened streets of London were as safe to walk in as any place in the world, and this is in contrast with authentic reports that crime in Berlin and other German cities was constantly increasing. In Germany the rich man could buy food which the poor man was unable to obtain.

The British policy as regards live stock was directed by the knowledge that there was a limited quantity of feeding stuffs in the country and that these should be largely applied to the production of milk first for children and then for adults. Cream was forbidden except on a physician's prescription and real butter was almost impossible to obtain. Instead of butter, one was given a little pat of margarin usually made of coconut oil.

In 1871 began the era of cheap bread grains imported chiefly from America to England, and gradually the wheat fields of England were converted into pasture lands for fine cattle and sheep. Cattle fodder was also imported and meat production acquired great proportions. Last year the idea was to plough up the grass land, to decrease the number of animals supported, and to feed to such animals as could be raised only those food materials which could not be eaten by man. The carrying out of such a program meant doing violence

[1] *Troilus and Cressida*, Act II, scene 3.

to the hereditary traditions of the agricultural community where individual profit had been supreme and the welfare of the state of secondary importance. In time of war, however, the safety of the state rises above the personal profits of an individual. It was realized that a decrease in the number of animals maintained would decrease the amount of fertilizer for use upon the soil, and so it was proposed to employ artificial fertilizers, such as ammonium sulphate, for the renewal of the soil. Professor Wood showed that the relation between the number of manure-producing animals and the size of the crops was exaggerated in the minds of the farmers.

The arrangement was such that the home-grown meat was divided among the civilian population, and the army and navy were provided by importations from the United States and the Argentine.

In May, however, the importations of American pork were on so large a scale that it could be purchased without giving up one of those precious meat coupons which four times weekly allowed an individual to purchase an amount of meat not exceeding five ounces, including bone.

The English army ration was a pound of meat and four ounces of bacon daily. Our own army ration of meat, having descended from British custom, was established by George Washington in 1792 at one pound of meat per day. The French army receives two thirds of this amount or 300 grams daily. The Italians have heretofore received less than this, but having been brigaded with French and English troops, they have acquired a taste for meat.

Major Ewing, who had charge of the nutrition of the Canadian troops quartered in England, gave a talk before the Royal Society Food Committee one day last winter and described how, in former years, he had cared for the provisioning of various gangs of men who were pushing a branch railroad from the Canadian Pacific Railroad up a valley in the Canadian Rockies. The Italians of the party lived more economically than the men of other nationalities and refused to buy meat. Their labor became poor and the situation was most unsatisfactory. Finally the company ordered that each man must have deducted from his wages at least $15 a month for food whether he ate it or not. This resulted in the Italians eating meat and in a great improvement of their working capacity. This experiment, however, does not show whether the benefit was derived from the meat itself or from the fat present in the meat.

Some American workmen leave a standing order with the butcher for a pound of meat a day or even two pounds. Wood in England has shown that it takes five times the quantity of fodder to produce a pound of dry human food in the form of steer-beef than it takes to produce an equal value in terms of milk, veal, and cow meat. The moral of this is that eating beef in large quantities is a distinct social loss to the community. The fodder used to produce steer-beef would produce a fivefold food value if it were used in dairy farming. The English have attempted to divert their reduced fodder supply so that it shall produce a maximum amount of human food.

The reduced meat dietary had no evil effect upon the British population last winter, and it is extremely doubtful whether the large quantities of meat prescribed for soldiers is in any way necessary. Colonel Murlin has found that when the choice is left to the men themselves, the troops in our home camps take less than three quarters of a pound of meat a day, or not far from the ration of the French soldiers, whose physical efficiency is unquestioned. With so many other precedents in the melting pot, it may

in future be possible to change the army ration established by George Washington and to reduce the quantity of meat to a more rational level.

In France bread was rationed; two thirds of a pound daily was allowed to civilian adults, about half a pound daily to children, and increased rations were given to people doing hard work. Bread cards were used and each coupon was dated. On May 16 at the railway station at Tréport on the French coast I was refused a piece of bread because I had only a coupon dated May 14. The difficulties of provisioning northern France last spring were due largely to difficulties of transport, the Germans having broken up important lines of railway. Préfet Mirman at Nancy told me that it was difficult to get flour to his people. I understood there was plenty at the ports of France. At the American Red Cross Hospital at Toul I was told that until the first of January it had been easy to get chocolate for the supper of 250 refugee children who were cared for there, but since that time chocolate had almost disappeared from the market.

In Italy wherever we went we found that a large plateful of either rice or macaroni was the prelude to the ordinary luncheon or dinner. Neither the French nor the British cared for this invariable introduction to a meal, while the Italians dining in London felt that the meals were unsubstantial. The national psychology of food is indicated by the English attitude toward corn bread. They did not like it. An editorial note in the *Pall Mall Gazette* stated that it was good news to hear that the bread supply of Great Britain was assured and that it was to be hoped that pig's food would be diverted in the direction intended by nature.

The Interallied Scientific Food Commission held its first session March 25, 1918, two days after the beginning of the bombardment of Paris by the Germans with the long range gun. The problems were to determine the quantities of food needed by each nation, the quantities produced by each nation, and the difference between these values which would represent the quantities of food to be imported by England, France, and Italy, and the exportable surplus of the United States.

The Commission decided to accept as the basic standard for the food requirement of each nation the quantity of food which would be taken by an "average man." The diet of an "average man" was defined as one containing 3000 calories "as utilized" or, allowing for waste, 3300 calories "as purchased," and 75 grams (about 3 ounces) of fat. It was resolved that meat was not a physiological necessity, especially when milk, cheese, and eggs in addition to vegetable proteins were present in the dietary. It was obvious, if a diet contained 3300 calories and was composed of foodstuffs ordinarily available, that there would be ample protein in the food.

In order to determine the requirement of energy in terms of calories for a mixed population of men, women, and children, it was necessary to establish the relative needs of food according to age and sex. The following figures were accepted as a basis:

RELATIVE NEED OF FOOD ACCORDING TO AGE AND SEX

Age in Years		Relative Food Needs
0–6		0.5
6–10		0.7
10–14		0.83
14 and over	women	0.83
14 and over	men	1.00

A woman at rest requires seven per cent less food than a man of the same size. The average woman is four inches shorter than a man, and, therefore, is of smaller size. The average woman cannot do the same amount of physical labor as a man. The women workers in the Woolwich Arsenal actually ate only about three quarters the amount

taken by the men workers. The values given for children are much higher than those accepted in former years, but accord more fully with modern knowledge.

Reckoned on this basis, the food requirements of the United States are presented in the following table:

PROVISIONAL ESTIMATE OF THE CALORIC REQUIREMENTS PER DIEM OF THE UNITED STATES OF AMERICA

Age in Years	Number of Individuals	Calories Per Person	Man Value	Calories in Millions Per Day	Per Cent
0– 5	14,384,000	1,500	0.5	21,576	9
6–13	15,003,000	2,300 *	0.77	34,507	13
14–18 M.	5,129,000	3,000	1.00	15,387	6
14–18 F.	5,084,000	2,500	0.83	12,710	5
19+ M.	33,770,000	3,000	1.00	101,310	38
19+ F.	31,073,000	2,500	0.83	77,683	29
	104,443,000			263,173	100

* Average of 2,100 calories between 6–9 years, and 2,500 calories between 10–13 years.
This amounts to 2,520 calories "per person" per diem. For the whole people for a year it reaches 96 million million calories per annum "as utilized," or 105.7 million million calories per annum "as purchased."

Chittenden and I calculated, so far as we could from the imperfect data then available, what our exportable surplus would be in terms of calories. That is to say, how much food fuel we could put into ships and send abroad to maintain the bodies and souls of those allied with us for the saving of civilization.

And the other nations calculated their needs in calories and the calories to be imported. They then determined how many tons of fat each country required in order to give 75 grams per average man. Subtracting from this the quantity of fat produced in the country, there remained an amount of fat to be imported in the form of meat, oil seeds, or dairy products. If the calories in these fat imports be deducted from the total calories to be imported, it leaves a remainder to be covered in small part by the importation of sugar, but in greater part by the importation of wheat and other cereal grains.

After this fashion it was possible for the representatives of the United States to hand to Mr. Hoover from the Interallied Scientific Food Commission a statement of the monthly needs of meat, fats, sugar, and cereals of each of the three European allied countries during the coming year. Previous to that time there had not been an ordered knowledge of the food requirements of the different peoples, but rather a competition to see which nation could do best for itself.

We who are here cannot appreciate all the strain which has fallen upon those in Europe. Our valor is attested equally with theirs, but England and France have fought for four years, we for four months. More closely than ever before we are drawn to England, with Westminster Abbey; to France, the home of Lafayette; and to Italy, with the Eternal City.

Lord Derby said the other day in Paris: "It is not too much to hope that, in that reconstruction of a new world, the Allies of today, in war, will be the Allies in peace, and that, side by side, England, France, and America will from this broken world reconstitute a new world, a better world, a world worthy of our sacrifices, and still more a world worthy of those who have laid down their lives on the sea, in the air, and on the land for the sacred cause of Liberty and Justice."

HOME OF THE HAVASUPAI INDIANS

In a tributary gorge of the Grand Cañon, protected from human intruders by almost unscaleable castle-like walls of rock, dwell the Havasupai Indians. The only approach from the cañon's rim is by a difficult twelve-mile trail winding under precipices and over narrow ledges until it descends to the oasis on the rocky floor three thousand feet below. (This trail enters the cañon at a point in the extreme middle distance of the photograph.) This valley floor is very fertile, maintained so by a system of irrigation ditches leading from small dams in the stream which flows through the gorge—"Cataract Creek" (hidden in the photograph by vegetation except for a short distance in the extreme right foreground). Each day in summer from sunrise until the heat of late forenoon, the men, women, and children of the tribe work in the fields, which stretch from cañon wall to cañon wall, cultivating crops of corn, beans, and squash, and caring for the small orchards of peach and fig trees. The Havasupai, like the neighboring Pueblo, provide against cold and famine by storing a year's supply of corn in the caves of the cañon walls. During the winter they retreat to the high plateau, where wood is more abundant and where they can hunt deer, antelope, and mountain sheep

The Havasupai of Cataract Cañon

A TRIBE OF INDIANS HIDDEN IN THE GORGES OF THE GRAND CAÑON OF ARIZONA PRESERVE THEIR PRIMITIVE LIFE

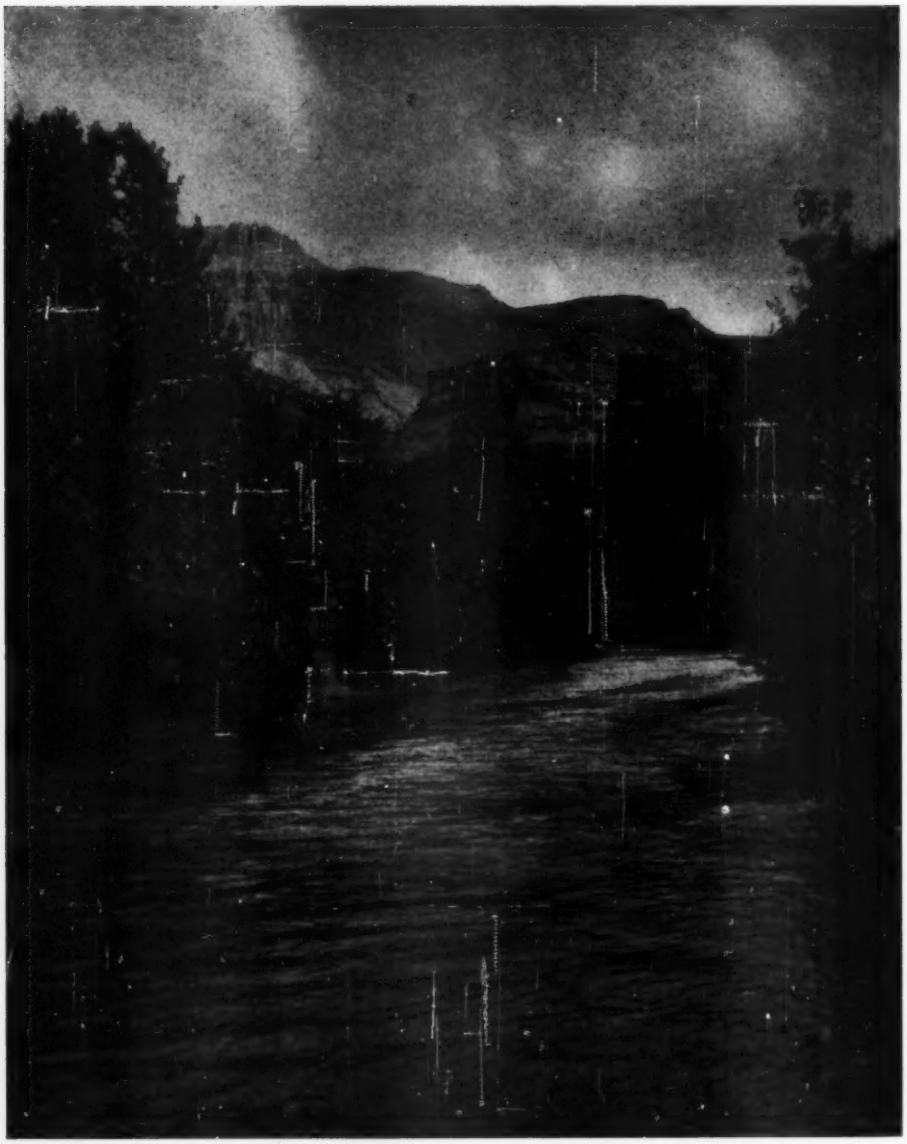
By LESLIE SPIER

IN the midst of unusual surroundings nothing seems strange, and that I found myself received as "ambassador from the white people" by the little known tribe of Havasupai Indians seemed quite in the order of normal happenings—after I had threaded the trail that swings through gigantic gorges to their cañon home. Certainly, they replied to my requests, if, in the outside world Havasupai modes of life were unknown to white people, the head chief himself would supply the needed facts, and would even requisition from the tribe such material as would make a suitable collection.

A month of traveling through the camps of the Apaches in central Arizona had left little expectation of finding a people less touched by civilization than they, even among the still primitive tribes of the Southwest. Late in the summer I arrived at the Grand Cañon and, with a party of Indians, made the journey westward across the forest-clad plateau to Cataract Cañon, the tributary gorge in which the Havasupai live.

Manakadja, hereditary chief, and his wife, Gwagwathgwave, are splendid types of old-time Indians. Dignified, courteous, and hospitable, they placed information and possessions freely at the Museum's disposal. They are shown wearing "civilized" clothes, for, following the Government assistance given during and after the flood in 1910, which washed away nearly everything the tribe possessed, the Indians never returned to many of their primitive industries. In fact, we secured for the Museum the only remaining example of a stone knife which they said they had forgotten how to make

From the rim of Cataract Cañon there is a three-thousand-foot descent into the narrow valley, and into this abyss the trail bravely plunges. At first it stretches away in easy stages, twisting through the pine trees or between cliffs which converge overhead, always descending. At last it arrives at the brink of a precipice, whence the cañon floor drops away in a series of titanic steps. The break reaches from wall to



MIDDLE REACHES OF CATARACT CREEK

The creek bursts from the rocky cañon floor in full magnificence, winds its way through the curves of the gorge, and rushes on to join the Colorado River. Occasional cloudbursts on the high plateau above pour their waters over the cliffs to swell the creek. It then becomes a torrent, filling the cañon and taking everything in its path. The Indians rely on this creek for irrigating their crops, as in Arizona rains are always infrequent and usually torrential

wall, completely cutting off the direct descent. A quick turn to the right, however, allows us to follow the trail out on to a narrow ledge hardly wide enough for the passage of our horses. Back and forth the trail winds, following the folds of the rock wall—here running out to pass a promontory, there returning into a cleft. To us, looking back, the horsemen appeared like tiny beads threaded on the ledge that suspended them in mid-air—always clinging to the face of the cliff which towers overhead close on the one

hand and drops away on the other side with nauseating precipitancy to the rocky floor below. Now we entered a cleft deeper than usual and arrived at the head of a great fall of rock, down which the rough trail zigzagged in bewildering fashion to negotiate the last drop of five hundred feet to the cañon bed. Following the example of my Indian companions, I dismounted and led my horse—not in the least envious of one foolhardy Indian boy who rode ahead, jumping his horse like a mountain sheep from rock to rock. Arriving at last on the comparatively level floor of the cañon, we mounted our horses again and rode rapidly forward along the arid bed of Cataract Creek. Still descending, through cactus thickets and over great rocks, we came finally upon the Havasupai oasis, fully twelve miles from our initial plunge over the rim.

Here Cataract Creek bursts forth in full volume to dash away along its rocky bed for about two miles before it tumbles in a series of cascades down another thousand feet or so to join the Colorado River. Over the dense thicket of willows and cottonwood trees that fills the cañon from wall to wall drifts the blue smoke from camp fires, in ethereal strata.

Set among the trees and difficult to delineate in the dusk are the brush-covered houses: some of these are rectangular with dirt-strewn roofs and brush walls; others are shaped like our own wall tents, but so low and so covered with dirt as to seem mere sand mounds; still others are rough log cabins such as the Navaho build; but the greatest number perhaps are dome-shaped, brush-thatched structures like huge beehives. Around them stretch fields of corn, beans, and squash, dotted with peach and fig trees, irrigated by ditches leading from the little dams which divert the current of Cataract Creek.

The life of these Indians of the cañon depths was most interesting to study and to enter into. With dawn the camps are awake, and after a hasty meal, men, women, and children are off to the fields. The early morning hours witness an almost feverish activity—planting, hoeing, reaping, or the more strenuous household duties and native crafts, such as scraping and tanning the rapidly drying deer hides; for with

The Havasupai still make fire on occasion with two dry sticks, one of which, the "drill," is held with its point against the other and then steadily twirled between the palms until a glowing heap of wood dust collects on the hearth. When this photograph was taken to illustrate the method, a brisk fire was made in less than a minute. When traveling, the Havasupai carry short fire sticks, the drill being set in an arrow shaft for use

sunrise in the cañon—as late as nine or ten o'clock—the heat precludes any further exertion.

The heat of the day is spent at the "club houses"—the sweat lodges which are a part of every camp. Usually only the most popular will be in use at one time; during the morning word will pass around that Kathoda or Wodo is going to make a sweat bath. There a dozen men will gather during the afternoon, each to enter the lodge the prescribed number of times, the sacred four. The lodge is the usual little beehive structure made air-tight by its blanket covering, hardly large enough for three or four men to crouch in beside the red-hot stones on which they sprinkle water to fill the lodge with steam. The extreme heat is terrifying in the intense blackness—but a plunge afterward from the doorway into the icy creek produces an almost ecstatic exhilaration. Then, joining others awaiting their turn outside the lodge, one stretches out on the sand, listening to the muffled songs or prayers for rain that come from the sweat house, and gossiping or discussing affairs of state with one's neighbors.

Or, if you prefer, you may stroll over to Tohawoga's where there is always a group of women gambling or weaving baskets, with occasional "bronco busting" for *divertissement*. But when the heat abates in the late afternoon, camp life suddenly springs up again; the men go off to gather in the last crops of the day, women leave to prepare the evening meal, and the acrid smoke begins to drift through the cañon as the shadows lengthen.

With abundant crops and a plentiful water supply the Havasupai have no fears except of rocks which may come tumbling from the heights above, and floods that infrequently pour through their cañon home. Men and women till the fields as the neighboring Pueblo do, and like them, they store a year's surplus corn in the rock granaries which line the cañon walls on a ledge high above the reach of floods. Deer, antelope, and mountain sheep abound on the plateau and in the gorges of the Grand Cañon. Work in skins is man's

Sinyella makes a dress. Work in skins is the province of the men alone; they hunt and skin the deer, tan the hides, and make the clothing, even the women's dresses (which are merely pairs of long aprons, worn back and front, and belted with a Pueblo girdle). This style of skin dress, however, as well as the men's leather leggings and shirts, is no longer in vogue, but moccasins are still made and worn

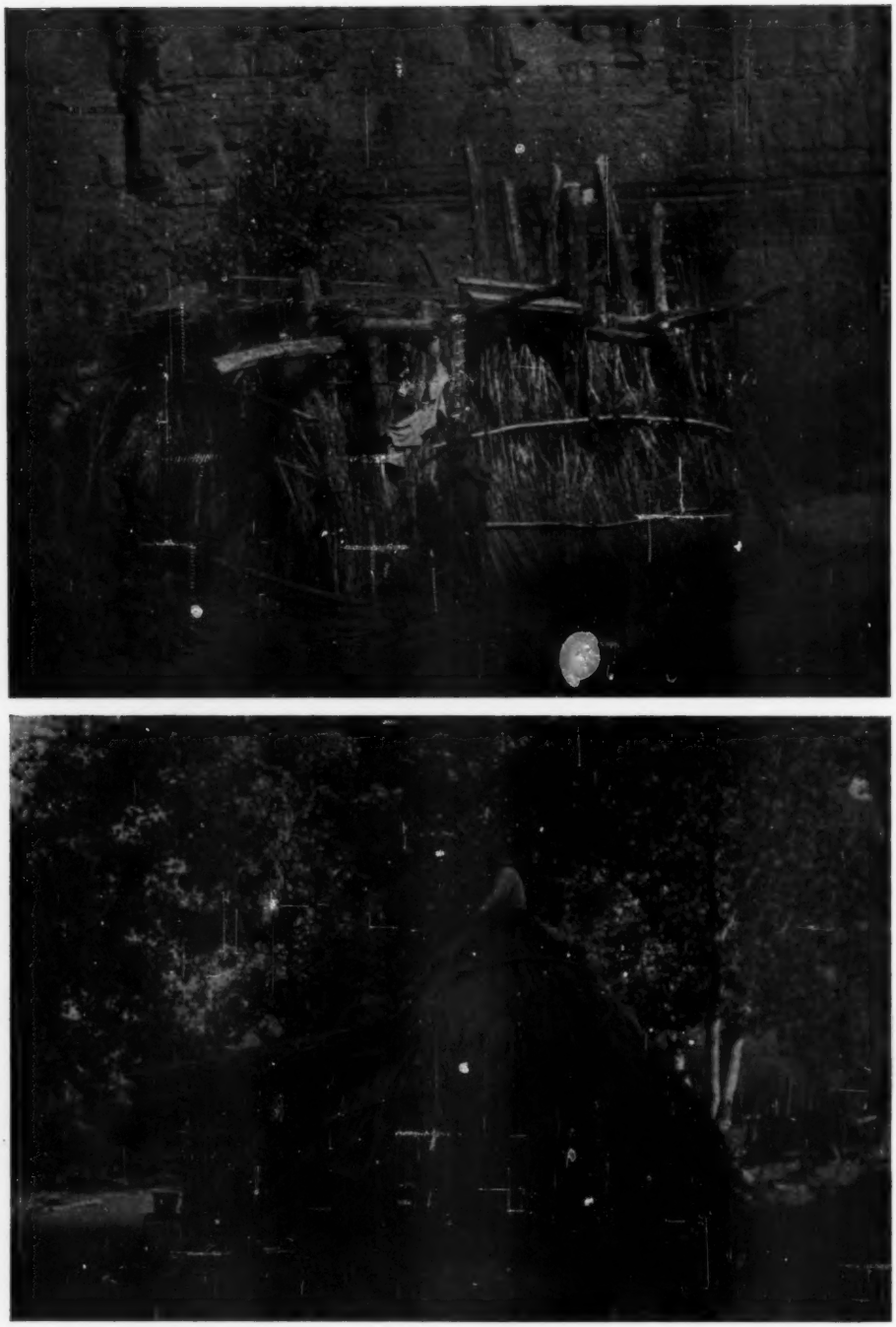
province alone, and from these skins the Havasupai still make moccasins, although the leather leggings and shirts and the man-made woman's dress are no longer in vogue.

The life of the Havasupai is epitomized by their baskets: simple and practical, yet with an infinite variety of uses. There is the conical burden basket in which the housewife carries home on her back the corn from the field; there is the heart-shaped pitch-covered jug for fetching water from the creek; shallow trays of coarse weave are for dry seeds and fruit, and similar baskets made water-tight hold liquid foods—and formerly were used as receptacles in which to boil food with heated stones; still other baskets are fire-proofed inside and seeds are roasted in them by being tumbled about with live coals. Metal vessels now stand all day on the fire where formerly it was native pottery that offered the continuous feast to visitors. Without her baskets and her grinding stones the Havasupai woman would feel lost.

Such simple worldly goods have offered little temptation to raiding enemies, but the difficulties of ingress into the cañon probably have proved the most effective barrier to the aggressive Apache and Paiute. The cañon Indians for their own part claim an unmatchable lack of military spirit, maintaining that their numerical inferiority—the tribe probably never numbered many more than the 175 of today—would not permit reciprocal raids, while abundant harvests at home aroused a feeling akin to contempt for seed-gathering plateau dwellers.

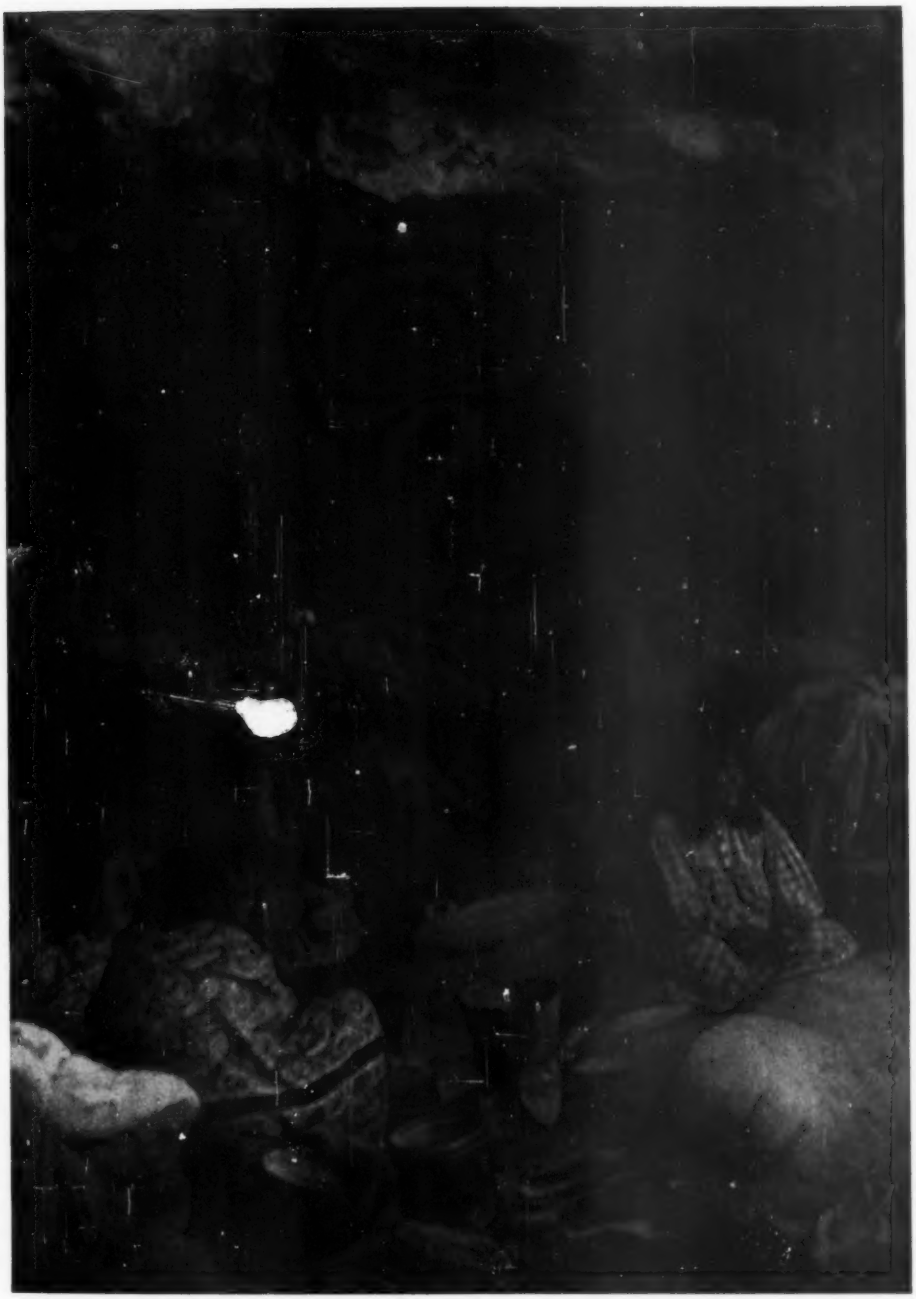
Harvest time brings the year's chief social diversions: the one great communal dance, and visits of the traders from foreign tribes. Food is abundant then; to quote their words, "Every day we have enough to eat, but at harvest time we eat all day." The village is a halfway station in the aboriginal trade route still flourishing in northern Arizona. The Havasupai first journey to the Hopi villages, where Navaho and even Zuñi from still farther east are met. Here buckskin and horns of mountain sheep are traded for woven products, and then comes the return journey, cautious because of fear of

Bows have their tempers, and no unseasoned haste produces a perfect weapon. Therefore, certain living trees are trimmed and trained to grow straight-grained, then are cut and scraped to size, and carefully fitted with string and arrows. The effective distance of the arrows is about thirty yards, although their range is much greater



TWO TYPES OF HAVASUPAI HOUSES

The brush-covered lodges are set among the trees where it is difficult to see them. Every man builds several—and then spends his days and nights, weather permitting, out of doors. Some of the houses are log cabins like the Navaho *hogans;* some are shaped like our own walled tents, but so low and sand-covered as to seem mere mounds; still others are rectangular with dirt-strewn roofs and brush walls, while the greatest number are brush-thatched structures resembling huge beehives, built in a style which these Indians claim as peculiarly their own



A SAFE RETREAT FROM FLOODS OR COLD

Wasamema's family retreats to the safety of this cave in the cliffs when floods threaten the home in the fields below. Such caves in the rocky walls are also snug refuges before summer sunshine tempers winter winds, and even in summer the less hardy members of the tribe sometimes take refuge here from continued inclement weather. These caves were once inhabited by a prehistoric pottery-making people who, it is supposed, built the only stone structure to be found in the valley

plundering Navaho. Later, the Walapai and Mohave from the west congregate in Cataract Cañon, to share the Havasupai harvest and to trade skins and other down-river products for the blankets and belts of the Pueblo.

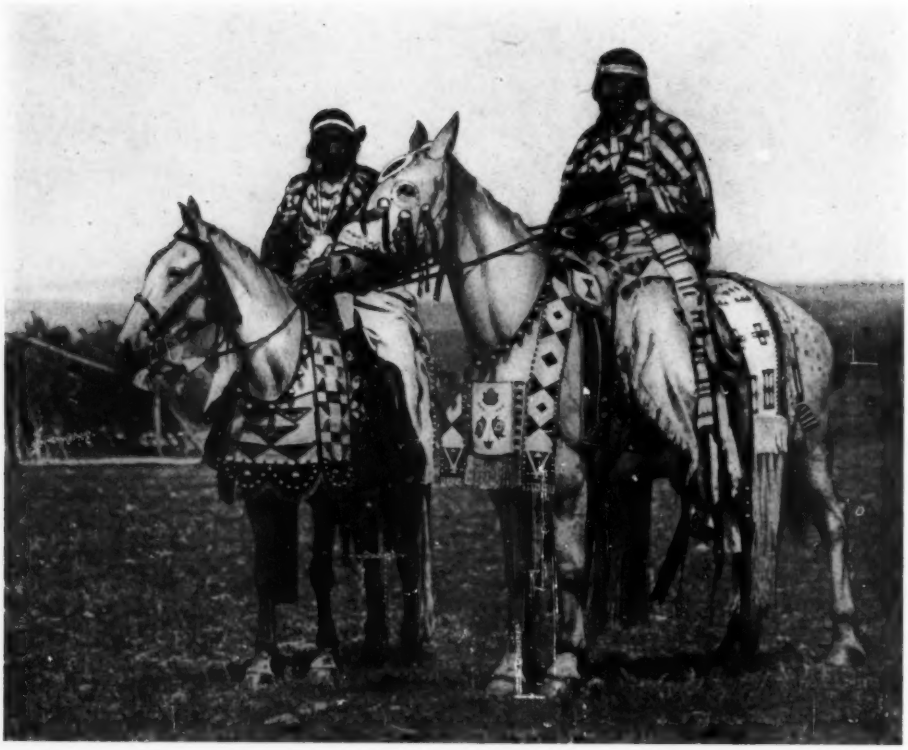
Late autumn sees an exodus from the cañon up on to the pine-clad plateau, where snug winter camps are made in the dense thickets. Here good firewood is plentiful and the hunting grounds are near at hand. Running water is not to be had, but little reservoirs to catch the occasional rains or melting snow undoubtedly served in the old days, as similar "tanks" do for their few cattle today. Winter cold, because of its humidity, is raw in the cañon, so the last dwellers to leave in the fall and the earliest to arrive for spring planting often turn troglodytes for a time, seeking refuge in the little caves along the foot of the cliffs. Sometimes continued inclement weather in the summer will cause the less hardy to leave their leafy shelters amid the jeers and gibes of their neighbors and huddle in caverns in the rocks. Curiously enough, as the Havasupai themselves recognize, these same caves were once inhabited by a prehistoric pottery-using people, who built the only stone structure in the valley, a little pueblo atop a low mesa.

Beautiful and fertile as the cañon is and secure from the depredations of warlike neighbors, it is by no means safe from nature's ravages. According to the Indians' account, in the spring of 1910 "it snowed four days, it rained four days" (I suspect again the artistic use of the sacred four), and with a sudden thaw, the thousands of miles of watershed drained by Cataract Creek let loose their floods down into the cañon. I saw such a flood on a minor scale, when the water poured over the rock walls until the cañon looked like a gigantic Niagara. In the flood of 1910, the people fled to the refuge of the cliffs, with the loss of only one blind old woman, while they watched the seething flood, which filled the cañon from wall to wall, complete its destruction below. Houses, horses, cattle, trees, crops, even the soil itself went in the rush of the waters. Thanks to prompt Government intervention the Indians were safely tided over to the next year's harvest. The United States Government's active interest of that time came to stay, and the cataclysm of the flood of 1910 marked a turning point in these people's lives, for by it they lost those connecting links with much of their ancient life to which they now have no incentive to return. The only stone knife that survived the storm, for example, was obtained for the American Museum, and they protested that with the subsequent disuse of stone tools they had forgotten how to make them. Literally, out of sight is out of mind in matters of a people's adaptation to life. But while the less serviceable arrowheads and skin clothing were never made again, the old-time everyday customs and industries sprang up anew, and, except for the effects of desultory schooling, their social life took on its old complexion.

So much of the old life of the Havasupai still remains: take away their guns, horses, clothing, metal tools and pans, and one finds that even their material existence, like their social life, is that of yesterday. Although Father Garces stumbled on the community in 1776, the California emigrants of '49 swung south past their cañon through enemy territory, and not until rediscovered by a railway exploring party in 1858 do we again hear of their existence. There was no regular intercourse with the outside world until recent years; in fact, many of the tribe claim to remember the "first" white man who came to them about forty years ago. But it is their geographical isolation which must be given the credit for their backwardness, not their mental outlook, which is a curious blend of an avid interest in things beyond the cañon's rim and a well-founded complacency toward life within its walls.

A HAVASUPAI "CLUB HOUSE"

During the intense heat of the day no member of the tribe works in the fields, so, while the women attend to domestic matters, the men gather to gossip at some one of their various sweat lodges, or "club" houses." These are huts of the low beehive type, but covered over closely with blankets to make them air-tight. Of the large number of lodges around camp only a few are likely to be in use on any one day. Three or four of the men crawl under the blankets into the lodge, where they sprinkle water on hot stones, producing conditions similar to those of a "Turkish bath." When thoroughly steamed they crawl out again and plunge headlong into the icy water of Cataract Creek. The exercise, as we may well imagine, is highly exhilarating. To get the full magical benefits, however, four men must enter the lodge at a time and each must reenter four times



Photograph of women of the Blackfoot tribe, illustrating the decorative art of the Plains Indians

Review of Wissler's "The American Indian" [1]

By ALBERT ERNEST JENKS

Professor of Anthropology, University of Minnesota

THIS new book by Clark Wissler, of the American Museum, presents in a singularly unbiased and unpedantic manner a critical summary of the important anthropological facts of the New World. It is, besides, a cyclopedia of anthropological sources for the Western Hemisphere.

No one in America, or elsewhere for that matter, is better equipped than Dr. Wissler to prepare such a book. His thorough theoretical training is combined with extensive practical field experience. To these is added a most valuable development due to a free opportunity in a great museum to plan his departmental work for a long period of years and systematically to work out his plan. He holds in his hands the anthropological purview of the Western Hemisphere—so far as scientific data are now available. Not until an immense amount of new data has been collected is it conceivable that another book will be likely to appear in the field Dr. Wissler has covered. The success of his endeavor is the occasion of keen appreciation on the part of his colleagues in America and the rest of the anthropological world.

[1] *The American Indian:* An Introduction to the Anthropology of the New World, 435 pages, with illustrations, maps, complete bibliography, by Dr. Clark Wissler, Curator of Anthropology, American Museum of Natural History, New York City. (Douglas C. McMurtrie, 1917.)

The book presents many facts of commanding interest to the layman, while complete bibliographical references to all specific contributions in the discussions are given, thus enabling the critical student to satisfy himself from the accepted sources.

Up to and including Chapter XIII, Dr. Wissler gives most successful discussions of the subjects of Food Areas, Domestication of Animals, and Transportation, Textile Arts, Ceramic Arts, Decorative Designs, Architecture, Work in Stone and Metals, Special Inventions, Fine Arts, Social Grouping, Social Regulation and Ritualistic Observation, and Mythology. Distribution maps greatly assist the reader to visualize the areas discussed.

In the first chapter, on Food Areas, we are told that there were in the New World eight distinctive food areas, each with its outstanding staple of preëminent importance. From north to south, roughly, these are as follows: caribou, salmon, bison, eastern maize area, wild seeds, area of intensive agriculture (to the exclusion of hunting), manioc, and guanaco. The layman will be impressed with the extreme importance of the food contribution of the aboriginal men of the New World to the economic life of today by the following partial list of exclusive world staples: lima beans, cocoa, maize, potato, peanut, tobacco, tomato, and turkey. Because of the broad sweep of view before the author, he presents such summaries as that in all food areas except the area of intensive agriculture the people were seasonal migrants, all agriculture was by hand power, artificial fertilization was extensively practiced, as was irrigation, and also alternation of certain crops. Most of the industrial complexes connected with foods developed by the Indians were adopted, and have been retained with surprising completeness, by the white immigrants in America.

Other interesting facts brought out in succeeding chapters are that in spite of the millions of milk-producing animals in the Americas, the natives nowhere used milk or its products; they trained no animals for draft, but used only hand power. Cloth was made of many fibers—such as wool, cotton, and hemp, yet the "tailoring art" centers around skin garments instead of cloth garments; it appears to have had its invention in Asia and from there spread to America, and to Europe relatively late.

The author's conclusion, under the discussion of "Decorative Designs," is that decoration is primarily realistic while symbolism connected therewith is derived from the completed decoration. A personal experience of my own may be illustrative here, and suggests as well that we often overdo explanations in our attempts to find definite meaning in all details of primitive culture. I was one day photographing a large collection of Pima baskets in Arizona. Two very old Pima women came along, and I asked them which of the designs they liked best. Without hesitation they selected three patterns. (They were old designs, associated in mind with the girlhood days of the withered old women.) When I asked the names and the meaning of the three different patterns, the women hesitated, conferred, and one of them finally said, "That one is turtle, because it looks more like a turtle than anything else." The other two they would not name. They told me that Pima basket makers searched over the desert areas picking up the large decorated red potsherds so common there. They carried home those of which they fancied the designs, and reproduced them, as nearly as they could, on their baskets. They sought decorative patterns; they named them if and when they had to do so.

Dr. Wissler's conclusion that "the art of making bronze was known in the New World, although the real purpose

of the process may have been the facilitation of casting," rather than the hardening of the metal, must be understood not to apply to the so-called copper implements so abundantly made from float or quarry copper of the Great Lakes area.

Under the head of "Fine Arts" are presented a few specimens of native literature. I must be content with calling attention to half a dozen lines from "an Inca hymn" (pages 141–2), which is one with the vocal yearning of the great souls of all ages and races of men:

"O Uira-cocha! Lord of the universe,
. . . . . .
My eyes fail me
For longing to see thee;
For the sole desire to know thee.
. . . . . .
Oh hear me!
Oh choose me!
Let it not be
That I should tire,
That I should die."

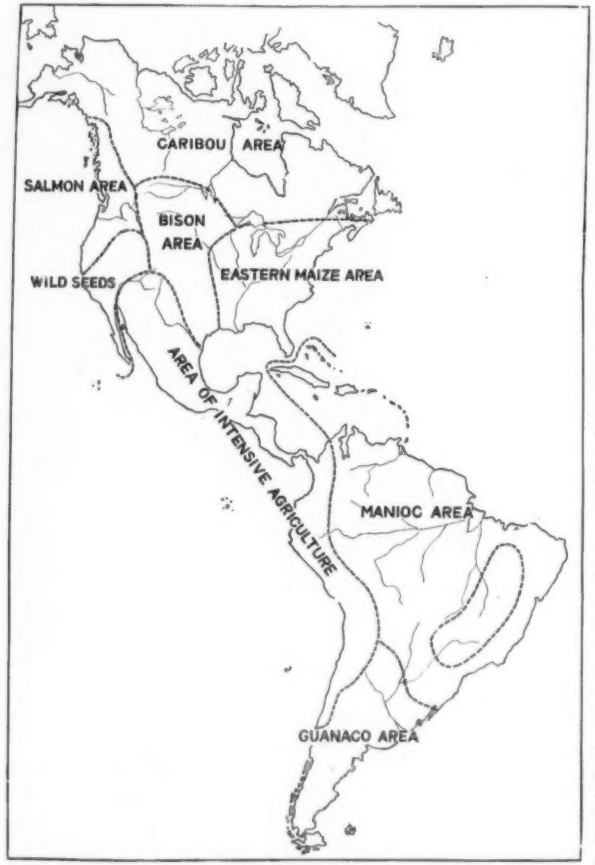
The time has surely passed when there is longer justifiable excuse for the "orthodox" religionist of today to say that all scientific researches of necessity rob modern men of spiritual yearnings and life. On the contrary, intimate knowledge of primitive peoples compels the anthropologist to see nothing plainer than that from earliest times the truly great men have struggled in a ceaseless endeavor to understand the purpose and meaning of God in their workable relations with the other men of their time.

Dr. Wissler's study of western culture shows that, whether the anthropologist studies the most measurable facts of culture or the less material traits, he finds unchallengeable claims to the unity of the culture of the New World.

Chapters XIV to XXI, inclusive, constitute the most original part of the book. First the great social groups are presented by descriptive text and map —such as the California area, the Eskimo area, the Amazon area. Then the archæological areas are similarly presented. Next, the author brings together what facts are now accepted on the chronology of New World cultures; the facts of linguistic classification follow (where Powell is justly given credit for probably as perfect a presentation of pioneer work as any pioneer scientist ever performed in so difficult a field). The very recent scanty data enabling an attempt at a somatic classification lead Dr. Wissler to conclude "that our best lead in the development of a somatic classification is to seek for correlated distinguishing characters in each recognized culture area."

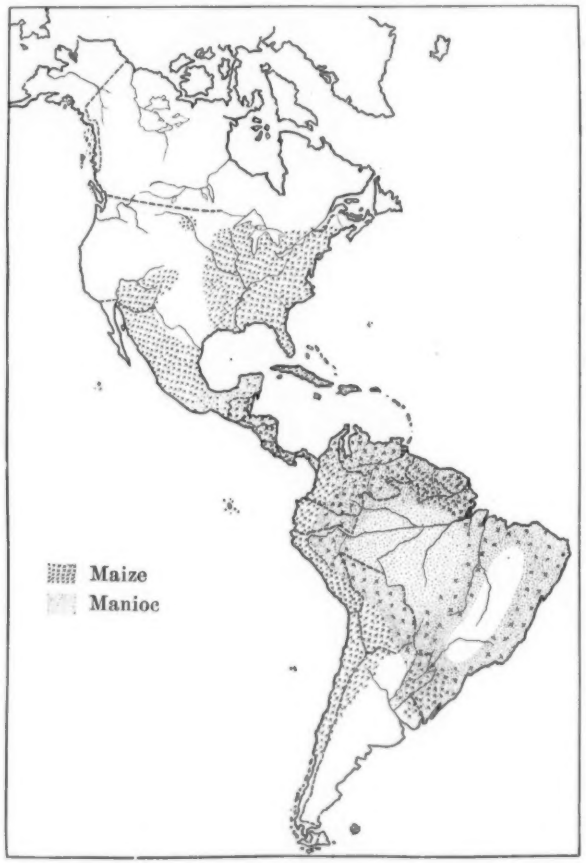
Many interesting, new, and suggestive conclusions are drawn by the author from this broad sweep over the New World as he thus has spread out before him the entire area multifolded, yet diversified by the several criteria of classification just enumerated. Among them are the following: "Language and blood seem to spill over the edges [of geographic areas] far more readily than culture" (page 336); "The location of food areas laid down the general lines of culture grouping" (page 337); "The origin of a culture center seems due to ethnic factors more than to geographical ones" (page 339); "While the environment does not produce the culture, it furnishes the medium in which it grows, and that when once rooted in a geographical area, culture tends to hold fast" (page 339).

Dr. Wissler has, in this volume, rendered a most valuable service to anthropology. Such a book could not have been prepared earlier in the field covered, and while the unsolved problems, as noted through the pages, are numerous, their statement will assist new students to visualize the problems, to attack them with greater intelligence and more reasonable hope of success.



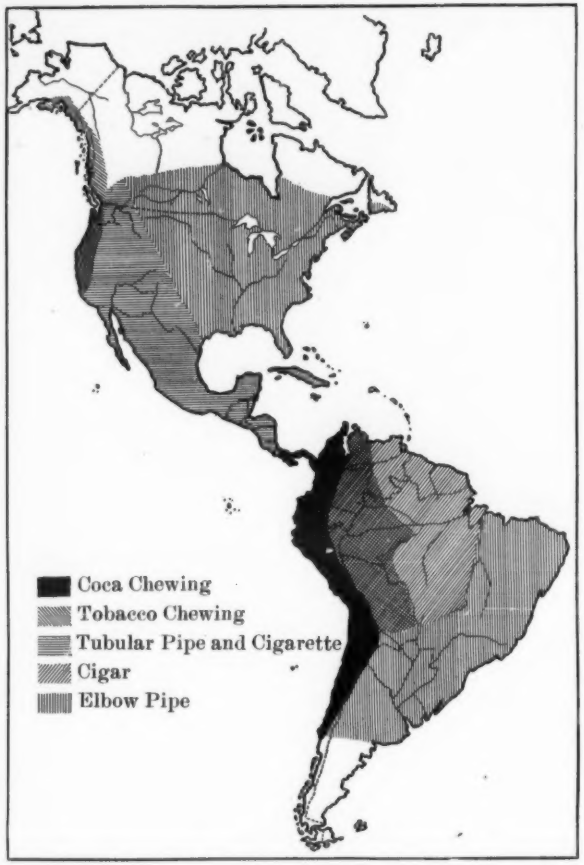
FOOD AREAS

Different groups of mankind specialize on some one kind of food, which naturally is the food most abundant and most easily procured. Throughout the habitat of the caribou, or American reindeer, in northern North America, two groups of generally differing tribes, the Eskimos and the Canadian Indians, placed their chief dependence for food and clothing upon this animal (the Eskimos depended upon the seal when the caribou migrated southward); farther south, the Plains Indians in early days relied upon the bison. Along the Columbia River, in which at certain seasons salmon congregate in immense numbers, a distinct food area occurs; while below, in California and eastward, acorns and smaller seeds formed the principal food supply of the Indians. On the plains of Argentina, in South America, the guanaco replaced the caribou of the north in the economic life of the natives. Between these two hunting regions lay the agricultural area, where maize, manioc, and other crops were cultivated. It is the assumption that the type of agriculture which prevailed originated with one highland tribe of Central America and was then diffused to the north and the south. One proof of the independent origin of the agriculture of the New World lies in the fact that before the discovery of America all the more than forty food plants known to have been grown by the Indians were peculiar to the New World, both the particular species under cultivation and their ancestors



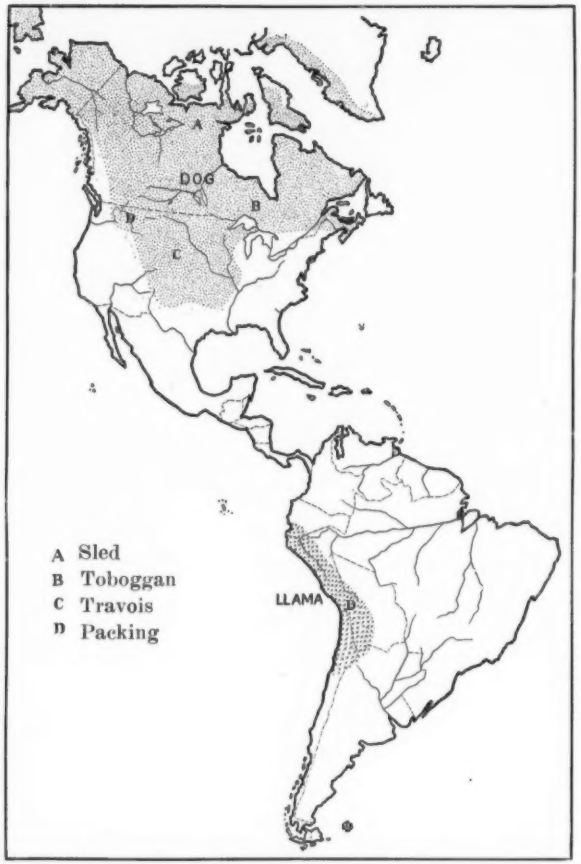
WHERE MAIZE AND MANIOC WERE CULTIVATED

Only two of the native food plants cultivated by the original inhabitants of the New World rose to the level of staples: maize and manioc. Maize, the more widely distributed, was used from Maine to Chile; manioc was confined chiefly to those parts of South America too warm and moist for maize growing. Around maize the art of agriculture appears to center. It is believed that the plant was developed from a wild grass in the Maya habitat, Yucatan, whence it was carried to the farthest limits of cultivation under native methods. The similarity of these methods throughout the maize area indicates a close connection between the spread of agriculture and the life of the early peoples. A full knowledge of the history of maize would throw much light on the development of the higher cultures of Mexico and Peru, and the probability that all varieties of corn that we still grow on our American farms were in existence by 1492 is an impressive suggestion as to the age of these early civilizations. Comparison of this map with the pottery distribution map, page 651, reveals a close agreement in the agricultural and pottery-making areas, suggesting that these two important industrial arts came into existence among the same people, or were invented at the same place, and were thence diffused outwardly over the two continents, probably at about the same time and in the same manner



NARCOTICS

The best known aboriginal narcotics were tobacco and coca. The use of coca still prevails (in the region represented by the darkest area on the map), and has spread to the natives of other parts of both North and South America, as well as to the whites themselves. The narcotic element in coca is cocaine which is a modern derivative. The native simply chewed the dried coca leaves, mixed with lime or other alkalis, that is, pulverized ashes or shells ground fine in mortars. This custom of mixing narcotics with alkalis is also practiced by chewers of tobacco in the territory adjoining the coca area and on the Pacific coast of North America. The appearance of this particular trait in two such widely separated areas and its analogy with the betel nut culture of Melanesia is a puzzling ethnological problem. Taking snuff also was correlated with the chewing habit. Smoking was the most widely distributed method of using tobacco. Three aboriginal ways can be localized: with the true or elbow pipe in the greater part of the United States and Canada and in the lower Atlantic side of South America; with the cigar in the West Indies and the greater part of the Amazon country; and with the tubular pipe, to which the name "cigarette" is applied, in Mexico, Central America, and the western United States. These methods grade one into the other



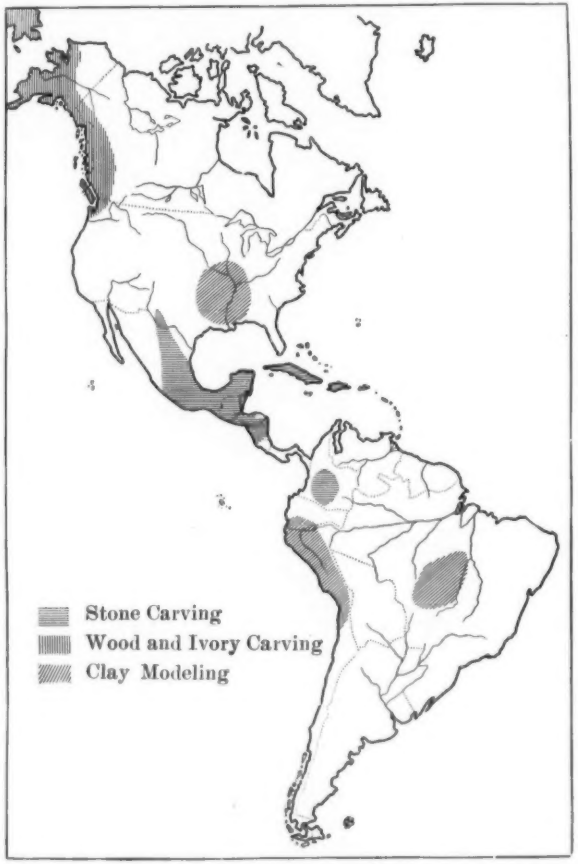
ABORIGINAL METHODS OF ANIMAL TRANSPORT

Before the introduction of horses into America only two animals are known to have been used for conveying burdens, the dog in North America and the llama in South America. The use of the dog in transportation was restricted almost entirely to the caribou and bison areas, with a sledge in the most northern part and a toboggan in the forested regions where the snow was too soft for sledge runners. The travois of the bison area was a primitive vehicle consisting of two trailing poles with a platform or net across them for carrying the load. Whether dog transport was introduced into North America from Asia or the reverse is a question that cannot be answered without further research. The complete absence of dog transportation in South America suggests that this institution was introduced from Siberia, for the practice is continuous from Scandinavia to Greenland. The agricultural areas made little use of animal transport; from Ecuador north to the Colorado River there is no evidence of anything but human carriage, but in Peru the llama was used. This animal has little more carrying capacity than a large dog, but is particularly well adapted for mountain travel and even today has not wholly been replaced by mule or horse

WHERE POTTERY WAS MADE

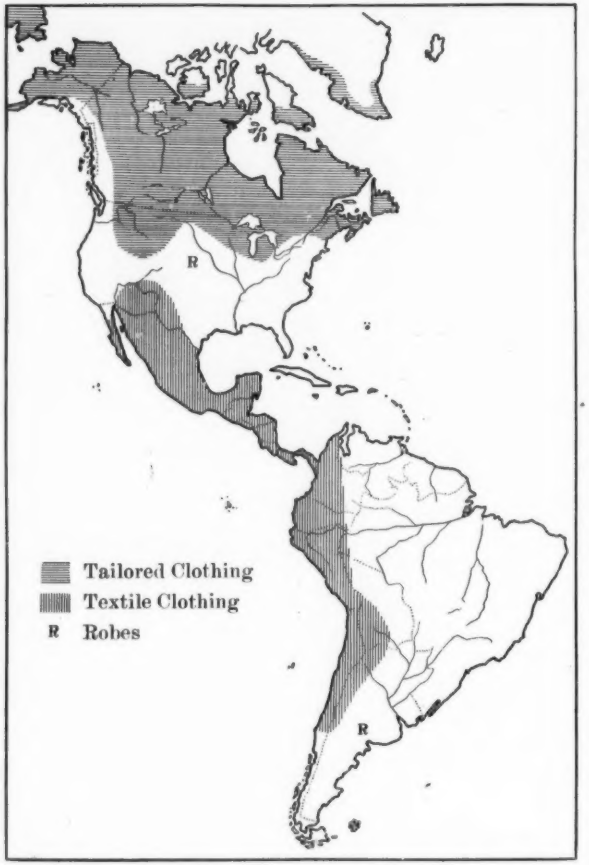
Mexico, the Antilles, and northwestern South America were the great pottery areas where the manufacture rose from being mere women's work to the rank of a genuine industry. From here the ceramic arts spread over North America (except in the case of the Alaska-Siberian pottery), covering virtually the same general region as maize culture which traveled by the same route. The potter's wheel was unknown in the New World, and as a rule vessels were built up by spirally winding slender clay rods; although around the Great Lakes, in Alaska, and a few other places the molding was done from a single block of clay which is, presumably, the more primitive method. Occasionally traces of the coils were left for ornamentation, but in general the clay was scraped smooth and to the desired thickness. Contrary to the Old World custom, glazing was not understood except for ornamental purposes, but in pottery paints the New World ranks high, both vegetable and mineral colors being used and made permanent by the proper firing.

Regional classifications of pottery are based largely on vessels made for ornamental and non-utilitarian purposes, for almost everywhere the cooking pot tends to be oval or hemispherical, and as we pass northward the pottery becomes more and more of this latter type. In North America the aboriginal pottery industry has survived only in the southwestern United States



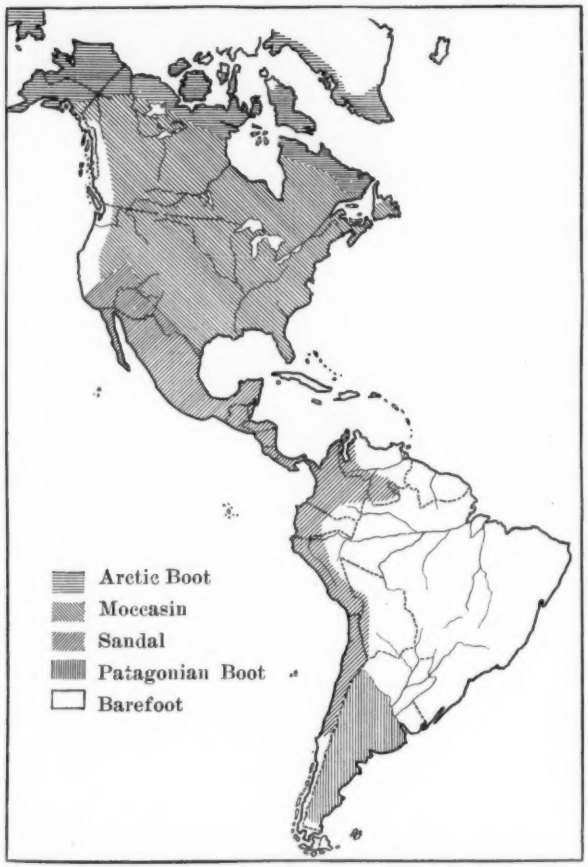
SCULPTURE, CARVING, AND MODELING

The center of New World sculpture was Yucatan, where stone carving was one of the most distinctive traits of the ancient Maya culture. From here it spread in a lesser degree through Mexico and Central America, but never reached north of the Rio Grande nor to the Incas of Peru. The best Maya work is to be seen in the famous stone turtles of Quirigua, although most of the carving was in low bas relief, little more than drawing. Wood carving, the leading art of the north Pacific Coast and Eskimo areas, begins with faint traces at the California border and grows stronger northward. Its geographical center is in Queen Charlotte Islands, where are found great carved totem poles and grave figures together with an endless array of smaller wooden objects. Still farther north, wood becomes scarce and ivory takes its place as a medium, until eastward along the north coast of Alaska the art of carving gradually disappears. Clay modeling reached its highest level in Peru, where animals and natural objects were represented with great fidelity, and human heads so well modeled as to suggest portraiture. The work was limited, however, to small vessels and figures, and nowhere among the Incas do we find anything like the life-size pottery figures of Mexico. On the whole, however, the aboriginal artists cannot claim high rank either as sculptors or stone carvers when their productions are judged by the classical standards of the Old World



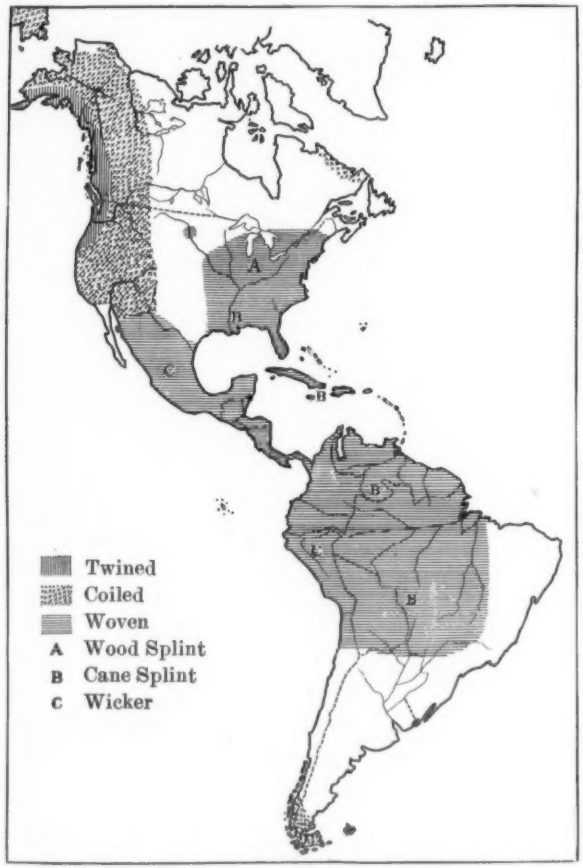
TYPES OF DRESS

In the north, throughout the reindeer and caribou area, well-tailored skin garments were worn, completely covering the body. The Eskimos and the caribou-hunting Indians cut out pieces of skin and fitted them together in intricate patterns, like a modern tailor, producing local fashions. The art of tailoring thus appears to have originated in connection with skin garments instead of cloth garments. It probably began in China, whence it spread to Europeans, then to the reindeer hunters in Siberia, and thence across the bridge from Asia into the New World. Along the Pacific Coast the aboriginal Indians were but scantily clad, while the entire maize area and extending down into Patagonia was distinguished by the use of a breechcloth merely, although a capelike robe hanging from the shoulders was sometimes worn. In Mexico and the Andes region, where the art of weaving reached its height, garments retained the angular form in which they came from the loom. Skin ponchos of the bison area so closely follow the form of the woven garments as to suggest historical relation



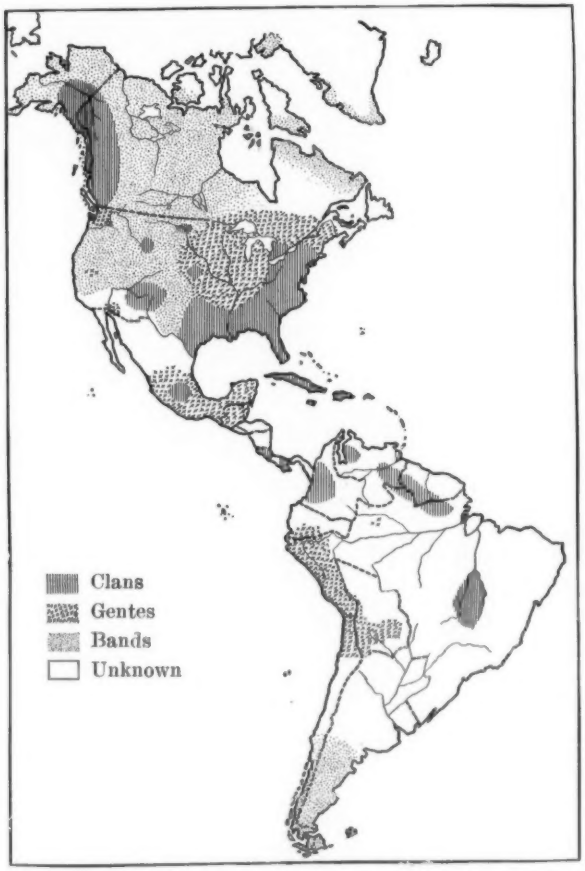
FORMS OF FOOTWEAR CORRELATED WITH TYPES OF DRESS

The moccasin, or skin shoe (with its modifications in the Arctic and the Patagonian boot), was the prevailing form of footwear in the New World except in the textile area where sandals were universally worn. On the bison plains a hard sole was substituted on the moccasin in place of the soft one found in the forests. Considering the geographical relation, this idea may possibly have intruded itself from the sandal wearers of Mexico. Going barefoot was the custom in the salmon area of the west coast of North America and in the southern half of the eastern maize area. Thence it extended through the Antilles and down the eastern side of the Andes to Patagonia. Here a leather moccasin again appears, but in the extreme south the Fuegians have a tendency to go barefoot. There are thus no apparent climatic reasons for the nature of the footwear, and the chief correlation with dress in general is the universal association, both in the Old and the New World, of woven garments with sandals



BASKET MAKING

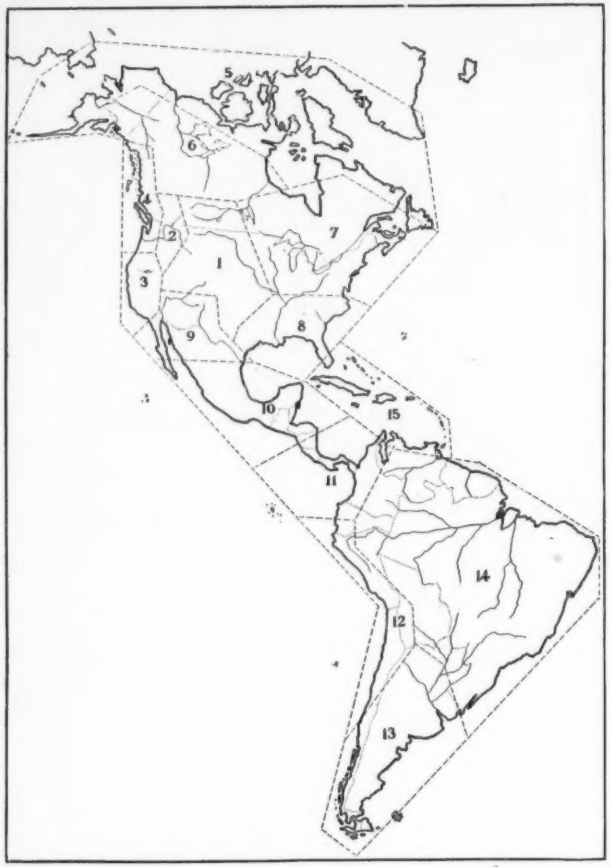
Basketry in some form is almost universal among primitive peoples, and in the New World it is difficult to find a tribe absolutely ignorant of the art. Two methods of manufacture, coiled and woven, apparently have separate histories. Coiled basketry reached its highest development among the Pomo Indians of California, where some of the finest baskets in the world were made, and from this center it extended throughout the western highlands of North America, from the Mexican border to Alaska. It is also found in eastern Siberia, in northern Labrador, and in Patagonia. Coiled baskets were made water-tight and used for cooking (hot stones were dropped into their contents). Woven basketry is found over the greater part of both continents, excluding the hunting regions. A common feature of the basketry from the Great Lakes southward into the manioc area was the use of splintlike materials, usually cane, but of splints of wood where cane was not available, as in New England. The chronological relation of coiled and woven basketry is an interesting problem



SOCIAL GROUPING

Among American Indians the nucleus of the social group was usually the family. Some energetic leader drew around himself his immediate family and relatives and then also such friends as had confidence in his leadership. Throughout the hunting and fishing areas of North America such groups exist as "bands," a number of which come together occasionally for tribal affairs. Each individual is known by his personal name, together with his band name, but like us, if his specific blood lineage is to be kept track of, it must be through his own memory.

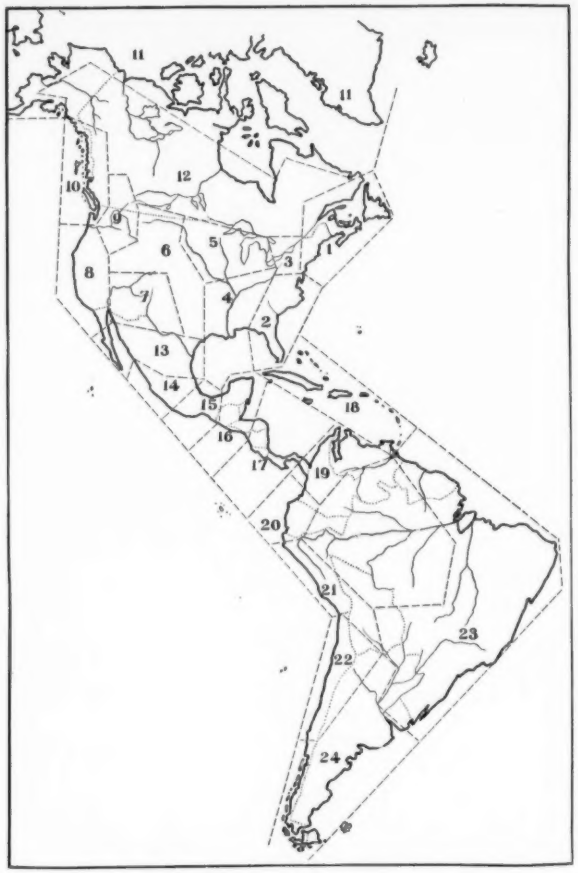
Among peoples of considerable intensive culture, especially in areas where agriculture was practiced (compare this map with the map of food areas, page 649), closer organization was found; in such cases the term "gens" is used for the group when the name descended through the father, and "clan" when it descended through the mother. Some of these groups are "exogamous," that is, the social regulation demands that individuals with the name of the same clan or gens cannot marry



HISTORIC CULTURE AREAS

Various parts of the Americas are very different topographically. Fitted into this topography, and adapted by culture, native tribes may be grouped into fifteen geographical areas; namely, 1, Plains; 2, Plateau; 3, California; 4, North Pacific; 5, Eskimo; 6, Mackenzie; 7, Eastern Woodland; 8, Southeastern; 9, Southwestern; 10, Nahua; 11, Chibcha; 12, Inca; 13, Guanaco; 14, Amazon; and 15, Antilles. The origin of these areas was of course the result of the accidental arrival of people there, but once these people became adapted to the environment, the social habits at the basis of culture were hard to change. Thus the culture became more and more stable, resisting even admixtures in blood or language—which probably were infrequent, as migration seems usually to have been limited by topography and the boundaries of the geographical area. The boundaries on the map are, of course, diagrammatic. Each area, however, contains a typical culture as a center (in the Plains Area certain tribes, Blackfoot, etc., form the type center; the North Pacific center is among the Tlingit, etc.; the Southwestern type is the Pueblo). Between these culture centers are tribal groups having intermediate cultures.

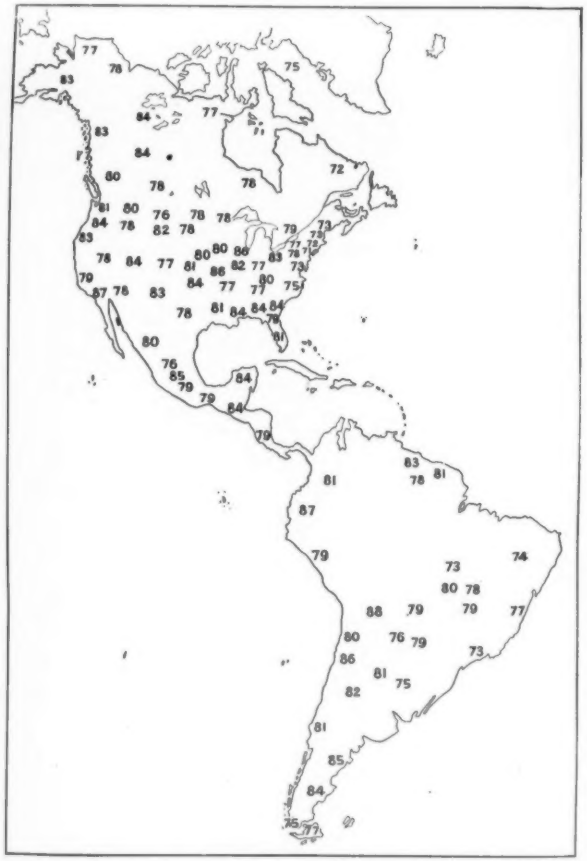
The period of time covered by historic culture is recognized as shorter than that of prehistoric culture. Dr. Wissler points out that to realize the aim of historical reconstruction, there is need especially for a great deal more stratigraphic field work and study of pottery in order to allow chronologies to be worked backward from historic times



PREHISTORIC CULTURE AREAS

Counting from the simple cultures at the north, through the intensive civilizations of Central America and Andean South America, to the simple fishing culture of Patagonia, the following characteristics of certain of the areas are typical: (1) *North Atlantic*—Shell deposits and rock shelters; (3) *Iroquoian* — Triangular stone arrow points; (4) *Mississippi - Ohio*—Burial mounds; (7) *Pueblo*—Community houses of many chambers around a court; (15) *Oaxaca*—High type of stone masonry—as also in Yucatan (16), and Peru (21) — with original quarries showing the use of stone tools; (16) *Yucatan* — Great cities, carved monuments, dated hieroglyphs; (17) *Panama*—With resemblance to Colombia (19) but individually excelling in gold work, cast, hammered, and alloyed with copper; (23) *Atlantic Highlands*—Urn burial; (24) *Patagonia*—Shell mounds.

Comparison of the two maps reveals similarity, eleven of the fifteen historic areas corresponding with prehistoric areas, and the other four (7, 8, 10, 11) embracing two or more centers of the earlier culture. The one map is separated from the other, only arbitrarily of course, by the discovery of America. A large part of the archæological material already dug out from ruins is probably historic, and further exploration will have to determine what, if any, independent prehistoric cultures ever existed here as are so conspicuous in the Old World where Stone Age cultures underlie later cultures of Neolithic time and these in turn those of the classical and historical periods



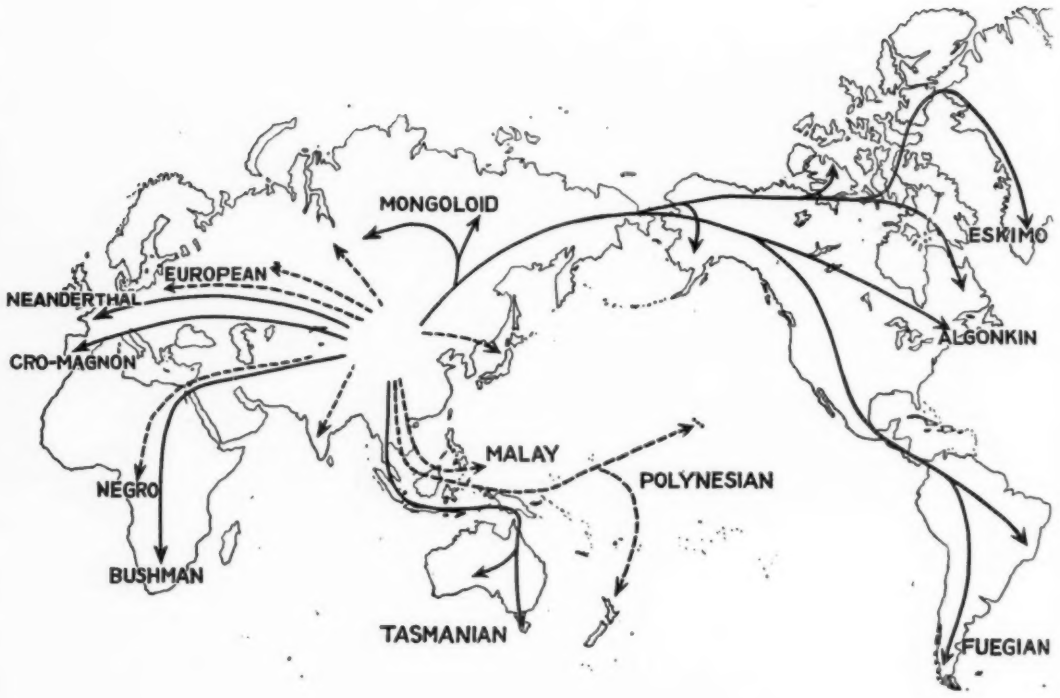
VARIATION IN HEAD FORM

All the peoples of the earth are closely related, but comparisons, especially of hair, skin color, and head form, allow us to classify them. All New World peoples have black, straight, moderately coarse hair. The skin color of all is brown ranging from yellowish to dark chocolate. The head form, known from skull measurements and measurements of the heads of living subjects, approximates an intermediate position between whites and negroes. The figures on the map indicate the cephalic indices of the various tribal groups in their geographical positions ("cephalic index" equals maximum breadth of head divided by maximum length—represented in per cent). Although there is probably but one general type of head form in the New World, the plotting on the map shows that, as an inheritable biological character, head form tends to vary within wide limits. Among the various Indian tribes we find not only very long heads but also some that are extremely broad. The tendency seems to be for any large isolated group of fairly homogeneous human beings to develop two variations in head form, one tending toward round-headedness, the other toward long-headedness. In other words, head form, like many other characters, tends to vary. That there is some lack of stability in head form among other races is probable, because investigations among the immigrant population of the United States reveal rapid changes in cephalic index

AREAS ACCORDING TO BODY CHARACTERS

Members of an inbreeding local group of natives come to resemble one another, like the descendants of one family. As a consequence continually increasing differences arise between groups. It is often possible to distinguish from a portrait alone Navaho, Apache, Pawnee, Teton-Dakota, Patagonia, or Eskimo. Adjacent groups, however, if fairly stable, mix to an extent tending to obliterate the differences. As in the case of stature, for instance, it is found that a group of tall natives is always surrounded by others more or less tall, and a short group by other short groups, without abrupt demarcations. Thus New World areas based on general similarity of inherited characters (such as stature, pigmentation, and head measurements), have type centers with radial variation from these centers and intergrading, just as have the areas based on cultures (see page 654).

In fact, on comparison of this map with the map of historic cultures, we see that the distribution based on physical characteristics closely follows that of culture. Further, Dr. Wissler makes clear that not only body characters and culture but also stock language, although independent human phenomena (the same language and the same blood being found associated with different cultures), always tend toward dispersion around the same geographical centers



COMMON ORIGIN OF AMERICAN NATIVES

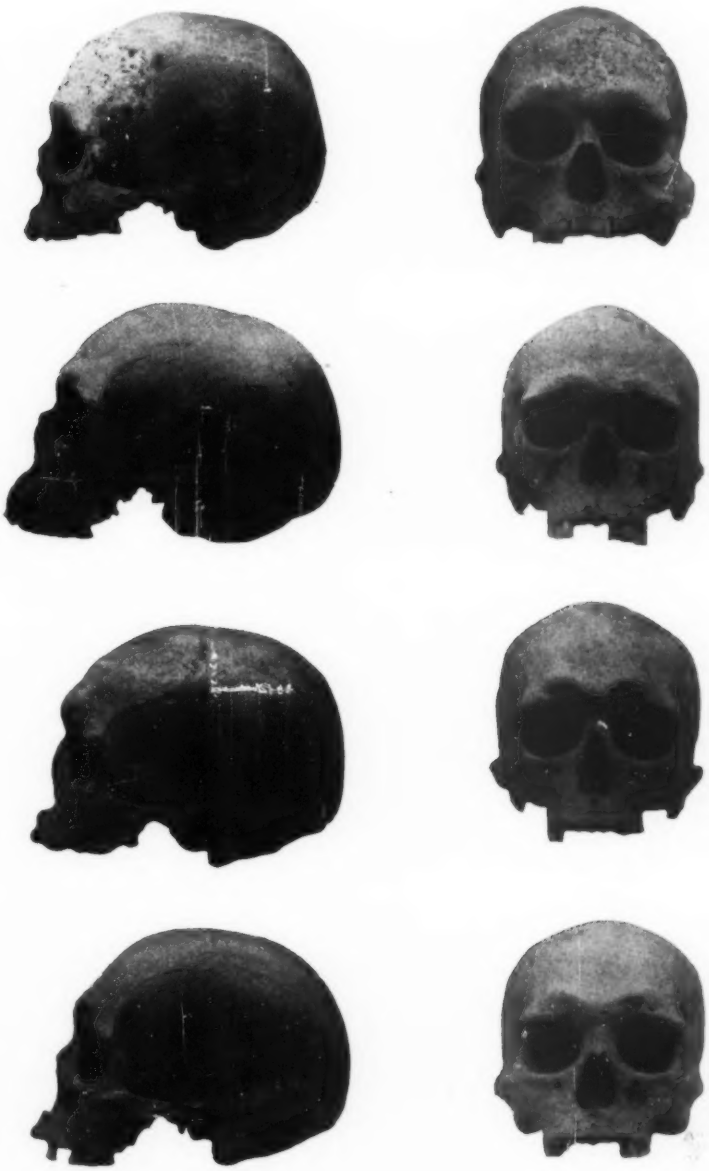
Shown on map of general dispersion of mankind from a center in Asia
(broken lines represent most recent movements)

From the great resemblance of all the peoples of the New World to one another, we may assume that they are of one stock. This common stock shows affinity with the yellow-brown Mongolian race of Asia. It entered the New World through the narrow northwestern route and spread out over the two continents, eventually becoming isolated in inbreeding groups, undisturbed until the occupation by the white population.

Dr. Wissler presents the question of the American native relative to the action of the polar ice cap which four times at least is known to have crept down from the north to cover the Asian bridge into the New World. He considers it reasonable that the peopling of the New World was interglacial and contemporaneous with the peopling of the Old World and not entirely postglacial (with an estimated age for the American culture of 20,000 years only), and that the return of the ice in the "Glacial Period" cut off the hemispheres from each other, leaving the diverged branches of stock to develop independently. The indirectness and narrowness of the bridge from Asia, added to the accumulations of ice which still hover about it, probably prevented the entrance of wave after wave of peoples such as poured over Europe.

The map indicates the dispersion of the branches of mankind other than this Asian-American, classified by certain anthropologists into two great groups: the Polynesian-European with fair skin and straight or wavy hair, and the Australian-African with black skin and woolly hair. Some regard the former as the main stem from which the Asian-American and African-Australian diverged and specialized.

A later classification designates almost the entire original population of Europe, Asia, and the New World as the generalized type, "Eurasiatic," with the variants from this type occupying the outskirts of land farthest from the swarming center in Asia, namely, Patagonia, Greenland, Cape Colony, Ceylon, and Tasmania, the British Isles, and Canaries. This theory seems to correspond with facts of distribution and culture in the New World; outlying regions must have proved veritable blind alleys where primitive man was brought up short and where in some cases his descendants are still marking time



LONG-HEADED SKULLS FROM THE ARCTIC COAST SIMILAR TO THOSE FROM CAPE HORN

Photographs of four skulls (front and side views of each) to show similarity between those from the extreme outskirts of New World dispersion, that is, the Cape Horn region of South America and the Arctic belt of North America. The upper two are Eskimo skulls from the Arctic coast; the third is from a village site on Grande Island (150 miles northwest of Cape Horn), and the last is Yahgan Indian, from Cape Horn (see map, page 655, for comparison in cephalic index). That the New World was peopled contemporaneously with the Old World is suggested by a certain parallelism existing between the skulls of ancient man in western Europe and skulls of American natives. The breadth of face of the Crô-Magnon man, for instance, suggests a New World character; vague likenesses have been noted between certain Palæolithic races of Europe and the Eskimo; the two Cape Horn skulls above show close relationship with the Eskimo. That we thus find these primitive men of western Europe and the primitive men in the outskirts of the New World longer headed and broader faced than the races massed in the centers of population is suggestive that researches in Asia may some day disclose that these very early types of the two hemispheres came from a common stock

Koryak
Asia

Tungus
Asia

Eskimo
Smith Sound

Eskimo
Greenland

Loucheux
Mackenzie Area

Lillooet
Northwest Coast

Ojibway
Eastern Woodland

Blackfoot
Plains Area

Menomini
Eastern Woodland

ASIAN-AMERICAN TYPES OF MEN

In classifying groups of mankind certain common characters are taken into consideration. The hair, for instance, in the main indicates great stability as to type and often is made the basis of first classification. As the hair of the New World tends to be black and straight, and this is also a distinguishing feature of Asiatic peoples, particularly of the Mongoloids, this may be taken as one very strong indication of common descent

Shoshoni
Plateau Area, U. S.

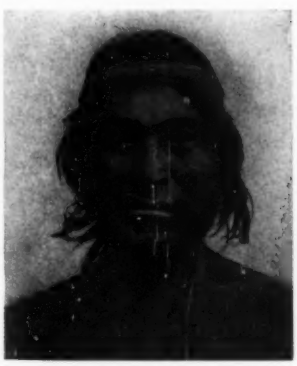
Maricopa
Southwestern U. S.

Huaxtec
Mexico

Chorote
South America

Bakairi
South America

Mataco
South America



Chiriguano
South America

Patagonian
South America

Fuegian
South America

NATIVE AMERICAN TYPES OF MEN

Besides the similarity of hair in the American and Mongoloid types, there is also agreement in the broad face and prominent cheek bones, the small, partly closed eyes, and the comparatively thin lips (also in a peculiar cavity of the upper incisors). In the American type, however, the color is usually darker and the nose larger, the latter being both broad and long and often with a convexity in the bridge similar to that of Semitic peoples

Yakut
Asia

Koryak
Asia

Yukaghir
Asia

Eskimo
Smith Sound

Thompson
Plateau Area

Kwakiutl
Northwest Coast

Mohegan
Eastern Woodland Area

Dakota-Sioux
Plains Area, North

Wichita
Plains Area, South

ASIAN-AMERICAN TYPES OF WOMEN

As a rule, women are less subject to environmental influences than men, and consequently do not show the recently acquired and special characters of a racial or local type; hence, also, a racial character once acquired is retained by them with greater tenacity than by men. A comparison of women from northeastern Asia and North and South America shows striking resemblances throughout

Apache
Southwestern U. S.

Aztec
Mexico

Nahuqua
South America

Bororo
South America

Paumari
South America

Chorote
South America

Mataco
South America

Chiriguano
South America

Fuegian
South America

NATIVE AMERICAN TYPES OF WOMEN

That the women of America have remained more nearly like their Asian prototypes than is the case with the men is partly explained by the difference in the rate of growth in the two sexes. While women reach maturity earlier than men, they still retain more of the characteristics of childhood. Special race traits appearing late in development are accentuated only in the men

Courtesy of Charles Scribner's Sons

A TREE FERN IN THE HIGH ANDES

The tree ferns of the Andes, which look at a distance like palm trees, thrive best in the relatively temperate, moist, and shaded areas of the forested mountain slopes. (This photograph was taken in a government camp at an altitude of 7000 ft.) About a third of Colombia is congenial to these arborescent ferns which are interspersed among the oaks, bean trees, and luxuriant shrubbery, forming a perfect "ocean" of forest. Here the explorer finds an abundance and variety of wild life that is almost bewildering—as well as a superabundance of sand flies fleas, and malarial mosquitoes.

Mr. Miller took part in six of the eight expeditions sent to Colombia by the American Museum, under the direction of Dr. Frank M. Chapman, for the purpose of making an ornithological survey of that country. His collecting carried him into regions almost unexplored—some even unmapped—which he describes with care and accuracy. Transportation facilities, for the most part, were limited to pack animals and porters, and some sections visited were almost impassable to even these primitive trains. In fact, Amazonian Colombia is so little opened up that Mr. Miller is the first ornithologist to enter this large and zoölogically rich area. Mr. Miller's additional travels (see map opposite page 664) through ten other South American countries, extended over nearly six years, during which time he traveled about 150,000 miles. All were American Museum expeditions, including the Roosevelt-Rondon South American Expedition

A Faunal Naturalist in South America[1]

By THEODORE ROOSEVELT

SPECIALIZATION, like every other good thing, can be carried to excess; and no forms of specialization are less desirable than those which make of the outdoor naturalist a mere collector of "specimens," and of the indoor naturalist a mere laborious cataloguer and describer of these specimens when collected. The outdoor naturalist ought to be able to do all the indoor work too; and he ought to have the power to see and to portray the life histories of the shy creatures of the far-off wilderness.

Photograph by Kermit Roosevelt
Courtesy of Charles Scribner's Sons

Mr. Miller, the author of *In the Wilds of South America*, with "Moses." — Mr. Miller's prime work everywhere, the work which is never neglected, is that of a keen mammalogist and ornithologist, but he is likewise an observer of men and manners, and a lover of beauty. He has written a book which will appeal to all cultured people who care for adventurous wanderings in out-of-the-way places, for studies of remote peoples, and for the gorgeous animal life of the tropics

But it is well if he can go even beyond this. No man leads a hardier or more adventurous life than the collecting naturalist whose quest takes him to the uttermost parts of the earth. He works in the wildest lands, and on the shifting borders where the raw outskirts of civilization merge into savagery. He works with the wild men of the forest and the desert, and with the men only one degree less wild who do the most primitive work of civilization on the borders of the forest and the desert. If he has eyes to see he will have many a tale to tell; and if he can tell it aright the tale becomes an addition to that shelf of true stories of adventure in strange lands which is so fascinating a part of the great library of worth-while literature.

Mr. Leo E. Miller is one of these men. At the moment he is a lieutenant in aviation, chief observer at Camp Jackson, South Carolina, and if the opportunity comes, all those who have seen him in times of hardship and stress in the wilderness know that he will make good. He has journeyed far and wide through the middle, the north, and the west of the great South American continent. He has seen the strange and curious things which are only to be seen by those who leave the beaten paths of travel. His prime work everywhere, the work which is never neglected, is that of a keen mammalogist and ornithologist. But he is likewise an observer of men and manners, a lover of beauty, and a well-read man of well-trained

[1] Colonel Roosevelt prepared this article for the JOURNAL during his recent stay at a New York hospital, showing his vast interest in natural history, his great energy even under the trying conditions of ill health, and his loyalty to the men whose work he had come to know personally on his expeditions.—THE EDITOR.

mind. He has written a book[1] which will appeal to all cultured people who care for adventurous wanderings in out-of-the-way places, for studies of remote peoples, and for the gorgeous animal life of the tropics.

Mr. Miller's observations on natural history are full of interest to the layman who possesses an intelligent lay interest in science; and it is very much to be hoped that he will sometime publish a special book on South American birds and mammals, giving their life histories as many men and women have given the life histories of North American birds and mammals. In the tropics he went from the reedy marshes and steaming forests of the plain to the cold alpine pastures which lie just below the snow line of the stupendous Andean mountain masses. He tells of innumerable species of birds, beautiful in plumage, or odd of form and of habits; of gaudy macaws, always flying in pairs, no matter how large the flock; of the gold-bird's ringing whistle, uttered as the singer stands motionless in the forest gloom; of birds so shy and furtive that it is almost impossible ever to see them, and of other kinds so tame that they live in the houses and climb into the sugar bowl; of humming birds that literally get drunk on the strong nectar of certain plants; of huge nighthawks looking like ghosts as they crouched on forest trails in the impenetrable gloom; of cow buntings in which the habit of parasitic egg-laying, in spite of the small relative number of the hens, has made them a real menace to most other forms of small bird life; of huge masses of waterfowl, from grebes to flamingos, in desolate desert lakes. A special, and a most delightful, chapter is devoted to the quest of that flaming wonder of the bird world, the cock of the rock.

The glimpses we get of other creatures are equally interesting. There are squirrels and possums as small as mice; howler monkeys whose roaring is in sound more sinister than that of lion or tiger; sloths which when angered not merely claw but bite—to me a most unexpected bit of information; jaguars which kill horses and cattle but are rarely dangerous to man.

Then there are the smaller things—aside from the innumerable insect plagues—which do attack man. The piranha fish, the size of black bass (but more savage than any sharks), are occasional man-killers; and Mr. Miller gives a really extraordinary account of one spot in which immense swarms of vampire bats attacked the mules, the pigs, and even the human beings with a fury that was dangerous to life. There are writers who make the personal note too strong. Mr. Miller's fault is the reverse—and it is a real fault, insistence upon which is not to be taken as a compliment to him. He slurs over his personal experiences in a way which detracts somewhat from the value of the book as a record of first-hand observation. For example, I happen to know that once while he was in the water landing a canoe, an Indian who was with him was attacked and badly mutilated by a piranha; but there is no mention of the incident in the book. And the sudden attack on him by a bushmaster, the most deadly of all poisonous snakes, is narrated in a way which may be modest but which deprives the incident of most of its narrative value.

The accounts of the human beings among whom he sojourned are as interesting as his accounts of the wild life. In the tropical lowlands and in many of the Andean regions, man, although in his Indian form he has dwelt there for tens of thousands of years, still finds nature so hostile that his race-life is a constant and doubtful struggle against degradation and destruction. The natives often refuse to heed the

[1] *In the Wilds of South America*, by Leo E. Miller, Charles Scribner's Sons, 1918.

Courtesy of Charles Scribner's Sons

ROUTES TAKEN BY THE AUTHOR IN HIS SOUTH AMERICAN EXPLORATIONS

ROUTES TAKEN BY THE AUTHOR IN HIS SOUTH AMERICAN EXP

commonest dictates of hygiene; in the past, great strange civilizations have sprung up, in the forest or on the high plateau, and then those who built them have perished utterly; and within historic times populous cities have risen, thriven, and then been wiped out of existence by mysterious and deadly sickness. Of the native races some persist in the presence of the invading white man, both perpetuating themselves and mingling with his blood, others are untamable and die rather than leave the savagery in which they have lived for untold generations. The whole chapter in which our author describes his visit to the rather despotic minion among the Yuracaré Indians is of especial interest. It was not until the south temperate zone was near that our traveler came out among conditions not substantially unlike those of our northern hemisphere.

Mr. Miller has written an admirable book; and the get-up, as usual with Charles Scribner's Sons, is as good as the book—which is more than can be said for certain good books recently written by other naturalists of repute and published by other firms. But I wish to make one protest, which is against the spirit of the times, which I know will go unheeded, but which ought to be made. A very few photographs like the Indian portraits by Curtis, are as good as pictures—they *are* pictures; good ordinary photographs serve a good ordinary purpose; but in a first-rate book there should be first-rate pictures, by first-rate men. They will be far better than the photographs upon which they are based and which gave them the needed foundation of accuracy in fact.

Mr. Miller with four of the negroes of Juntas de Tamaná on the west coast of Colombia.—He speaks of these as a miserable, sickly lot, too indolent to grow the plantains, yuccas, and other plants that thrive with a minimum of attention. This part of the San Juan River watershed, into which the naturalist's search for out-of-the-way places carried him, has rarely been visited because of its adverse climatic conditions, notwithstanding that it is noted for fabulous wealth of gold and platinum. Epidemics of malarial and yellow fever scourge the country. Rain pours daily, averaging four hundred inches a year, and when the sun does shine, the forests are turned into a steaming inferno under the tropical heat. After the return of the exploring party to the highlands, the members paid the inevitable cost of penetrating tropical wilds by spending several weeks on their backs recovering from the fevers with which they had become inoculated

AN INDIAN HUT IN THE YUNGAS OF CENTRAL BOLIVIA

"Yungas" is the name given to the fertile mountain slopes which have been cleared of forests and cultivated. Mr. Miller was invited to hunt birds and mammals on this plantation belonging to a citizen of Cochabamba, who visited it but three times a year to supervise the Indian laborers in picking and packing the coca leaves. This part of Bolivia is an agricultural paradise, yielding besides coca (the source of cocaine) many other tropical products, among them coffee, cocoa and sugar cane. Cultivation is on a small and primitive scale, however. The value of a plantation depends upon the number of Indian colonists settled upon it, so that the aim of the owner is to keep his Indians satisfied. These Indians of the Yungas are of better build and also of better disposition than those of the plateaus; their condition is much superior and they have lost some of the melancholy which seems to have fallen on all the natives subdued by the Spaniards. The Author gives an account of immense swarms of vampire bats which, at this place in the Yungas, attacked the mules, the pigs, and even the human beings with a fury that was dangerous to life

AT THE SNOW LINE ON AN ANDEAN PASS

In wandering from the beaten paths of travel the expedition was frequently forced to attach itself to such local travelers as might happen to be going its way. This picture shows the expedition in the Cuchicancha Pass, Bolivia, accompanying the mail carrier's train which makes the trip from Cochabamba to Chaparé at six-week intervals during the dry season. Travel through most of this country is by mule trains. At night the packs are piled together and covered, while the mules are simply turned loose, the leader wearing a bell tied to his neck. After they are rounded up in the morning any one of the number which has strayed off can be easily recalled by the loud ringing of the bell

IN INCA COSTUME OF FIVE HUNDRED YEARS AGO

The Author's accounts of the human beings among whom he sojourned are as interesting as his accounts of the wild life. This photograph of Quichua Indians was obtained in their remote mountain homes of Bolivia where man, although a dweller there for tens of thousands of years, still finds nature so hostile that his race-life is a constant struggle against degradation and destruction. The Quichuas, the prevailing stock in the central section of western South America, are the descendants of the inhabitants of the ancient Incan Empire, but today they are a cowed, fearsome, and melancholy people. Some of them persist in the presence of the invading white man, both perpetuating themselves and mingling with his blood, while others are untamable and die rather than leave the savagery in which they have lived for untold generations. All the tribes in the past shared in the general culture of the Incas, which they have in part retained. The women still wear homespun, dark blue or colored skirts and varicolored shawls, and the men knee breeches, blue shirts, embroidered belts, and the inevitable poncho, which represent, apparently, the traditional costume. The "trench helmets" they have on their heads are peculiar hats made of hardened skin

made of hardened skin

THE WILDEST OF THE NORTHERN INDIANS OF SOUTH AMERICA

At Dabeiba, northwestern Colombia, Mr. Miller made the acquaintance of the Cuña Indians, a linguistic stock that has kept remote from foreign interference. The women are customarily clothed, but in the forests the men wear only a breech-cloth. Their large muslin sheets seen in the photograph were provided by the priest and worn only in town. The heavy necklaces of silver coins are a modern substitute for gold disks which they once hammered from metal washed from the mountain sands.

Even at the present time the Indians are numerically the main element of South American population. Over a large part of the continent they still live in their primitive state, while they form the "peasantry" of those sections reached by civilization. Mr. Miller found them useful not only as porters, but also in his bird and animal hunting where their bows and arrows and especially their knowledge of woodcraft enhanced the expedition's scope far beyond what it otherwise could have been

FIELD OBSERVATIONS IN BRITISH EAST AFRICA

(Mrs. Akeley and J. T. Jr.)

As I was using the binoculars, J. T. climbed to my shoulder to see too. We may doubt, however, whether she derived any benefit from the glasses—in fact, she preferred turning them around and looking in at the big end. Like a human child, she was inquisitive, "butting into" whatever we were about and using her hands and teeth with which to explore any strange or unusual object. She little needed any optical assistance, as she could distinguish familiar objects at great distances. She more than once proved that she recognized me far beyond the range of the unaided vision of members of the expedition. For things near at hand her sight was almost microscopic, and she would make a great fuss over picking from her fur some tiny speck of dust which we could scarcely see

Notes on African Monkeys

WITH THE PERSONAL STORY OF J. T. JR.,* WHO TRAVELED TWO YEARS WITH THE AKELEY EXPEDITION IN AFRICA, WAS BROUGHT TO AMERICA IN 1912, AND NOW MAY BE SEEN IN THE NATIONAL ZOÖLOGICAL PARK, WASHINGTON, D.C.†

By MRS. CARL E. AKELEY

Illustrations of J. T. Jr. in Africa from photographs by Carl E. Akeley

ON the Akeley African expeditions of 1908–1909 and 1910–1912, for the collection and study of elephants, the first for the Field Museum, Chicago, the second for the American Museum of Natural History, New York, I had splendid opportunity to observe many of the small African mammals. The black boys of the expedition would bring them in to me so that I had a "zoo" of considerable size at each camp—young antelopes, hyrax, and monkeys—although we carried few of the animals from camp to camp.

Greatest of all delights, however, were the long hours I spent watching such animals, especially the monkeys, in their own home life. During the weeks we were at "Tembo Circus,"[1] whenever it chanced that I did not accompany the day's hunt and was left alone in camp, I would go out, taking a black boy with me, and sit down under the trees, which were very high, from one hundred to one hundred and fifty feet. I would even lie down on my back in the grass—with the boy stationed on guard behind me so that leopards could not creep up unawares—and watch the *Colobus* monkeys[2] in the trees.

At first everything would be quiet, apparently with no monkeys to see. I would be sure, however, that they were seeing me. Soon their curiosity would get the better of them. One would peek out here, others there and yonder. Then they would come down a little closer to get a good look at me. Sometimes they would bark and scold. It is difficult to see *Colobus* monkeys owing to the wonderful way they have of hiding themselves among the leaves; also the black and white of their coats blend with the color of tree branches and with the black and white of the tree lichens. These monkeys have no thumbs, but the lack does not impair their grasping power, and as they travel from tree to tree they may leap twenty or thirty feet, their long plumed fur spreading in the air. They are very beautiful indeed as they sail downward, and to watch the *Colobus* mothers with their babies is a sight not to be forgotten. They are so careful and loving with them and are evidently as worried if the baby is hurt or sick as human mothers might be. I

[1] The name given to the camp near the spot where Mrs. Akeley shot the record Kenia elephant. See "Elephant Hunting on Mount Kenia," *The American Museum Journal*, November, 1915.

[2] This genus of monkeys will be illustrated in a succeeding issue of the JOURNAL in connection with a series of pictures of some of the habitat monkey groups in the American Museum.

* Named after Mr. J. T. McCutcheon, the cartoonist, who was traveling with the Akeley expedition at the time J. T. Jr. was captured.

† It is said that all African monkeys bite as they grow older. So it proved with J. T. We kept her until she was about eight years old, but she bit me twice, so we had to send her to the National Zoölogical Park. There she can get out of doors every day in her cage, which is large and kept very clean. She can play on the ground, dig up the stones, and eat the dirt as monkeys like to do. I go to visit her sometimes and she recognizes me. Apparently she has become very much accustomed to adapting herself to existing conditions. It is known that monkeys live a good many years. One at the New York Zoölogical Park is twenty-eight years old.—THE AUTHOR.

should say that monkeys probably make better mothers than very many of the natives we saw in Africa.

One incident that we witnessed in connection with the *Colobus* monkeys is hard to understand. We were studying them at Kijabi for a group for the Field Museum, and shot some of them for specimens to mount. When one of the young monkeys was wounded and fell to the ground, an older monkey came down out of the tree and killed the wounded one, and then made its escape.

J. T. with her "chamberlain" and full regalia. This picture with Allie, her "nurse," as we always called him, was taken immediately "on the equator" near Eldama Ravine in British East Africa. She rode on Allie's shoulder or head in our travels from camp to camp and was usually fed by him, but, as she was accustomed to a life on the forest-covered banks of streams, the glare of the sun made her sick, wherefore the umbrella. In going about their own business in their own way the guenon monkeys (*Lasiopyga*), to which genus J. T. belonged, are very wiry and agile. They travel through the forests, swinging from branch to branch, and even make long and warlike excursions into distant parts, but the strange monotony of human travel was very fatiguing to J. T.

The baboons are amusingly human in taking care of their babies—as I discovered during a two weeks' stay we made on the Lucania Hills. These hills are alive with baboons, hundreds and hundreds of them in troops or families, —one family used to come every night to sleep in a tree just back of our camp. The mothers with the young monkeys on their backs climbed the rocks; even though the wall seemed absolutely perpendicular, these baboon mothers would find a way up. The big old male baboon, weighing at least seventy-five pounds, would come down perhaps fifty yards nearer our tent than the mothers, who stayed with the babies on the rocks above. Here he would sit on scout duty, his chin propped on his hand, where he could see over the whole country.

Meanwhile, the mothers prepared their children for "bed" by taking them on their laps and picking off the burs and ticks. If one of the babies, with its head hanging over the mother's lap, would try to play, reaching out its hands to another baby on the ground, the mother would take it up and slap it and shake it just as human mothers do, then put it down again and go on with her work. And the baby would squeal and the other little one would run off. The one punishment was never sufficient, however, to teach the baby to lie quiet, and it would have to be spanked two or three times before it was ready for bed.

Then the children would scamper off up into the tree and we could hear them squealing and fighting for the best places—probably to get next to their own mothers. It grows dark very quickly in equatorial Africa and they

have to hurry. One night we were awakened by a great commotion among the baboons. In the morning we found that a leopard had been there, and after that the baboon family did not come to its tree.

The natives are very much afraid of these baboons, which not only come down into the gardens and eat the corn and dig up the sweet potatoes, but also sometimes carry away little children. The old male is frightful to behold, a very vicious animal with long fangs. When we were hunting in a forest of Uganda, the natives came to us begging that we kill some baboons which had taken a child and which they could not drive out of their gardens. One of these baboons, later shot by Mr. Akeley, was the largest we had ever seen.

About the camp fire at night we never tired of talking over what we knew of the ways of these monkeys and of the other creatures in the African wilderness and of relating tales of our daily adventures. One evening the talk chanced to turn upon our zoölogical gardens at home in America, and we all fully and emphatically agreed that we did not believe in taking back these free creatures, monkeys, lions, elephants, or any others, to unnatural conditions and a life of captivity and homesickness. Some of the party cited the monkeys of our "zoos" as especially pitiable under the conditions of their imprisonment, so much so that there had been created in the minds of many people a feeling of repugnance for the whole monkey race. At this point I decided that I would capture and introduce to the company a *wild, free* monkey for comparison. But I had no idea at the time that the captive would prove of interest to me for so long a period of years.

So J. T. was brought into camp just to let the friends who were with us, Mr. J. T. McCutcheon and Mr. Fred Stephenson, see the difference between a wild monkey and the zoölogical park specimen. Our porters made a basket-like trap and baited it with corn, and the monkey was only frightened when the basket fell snugly over her. We judged she was six or eight months old; and she surely was just as saucy as she could be. She was not afraid of

An afternoon call on a little Boer girl of the Uasin Gishu Plateau (note the tender pride of guardianship in Allie's face). Monkeys are suspicious of strangers, even of monkey strangers outside their own clan, but they possess an underlying sociability easily developed into friendship. They have long memories for both people and their acts, and have been known to repay a grudge as well as a kindness after a considerable lapse of time. Among one another the members of any band of monkeys are likely to be affectionate, and monkeys probably make better mothers than many of the natives we saw in Africa. J. T. undoubtedly was lonesome for, because of the expedition's rapid change of base, she could rarely have other monkeys to play with for more than a week or two at a time

Near the summit of Mount Elgon, an extinct volcano of the East African highlands. J. T. suffered from the cold and from mountain sickness when taken into too high altitudes

J. T. admires bouquets of African wild flowers, but her appreciation is largely limited by her sense of taste. She liked to nibble many kinds of flowers, especially the wild gladiolus. Monkeys of J. T.'s species are mainly vegetarian, searching out fruits, bulbs, and berries, but they also very cleverly catch and eat caterpillars, beetles, white ants, and locusts. They readily distinguish between poisonous and edible insects, and it is even very difficult to trap them with artificially poisoned food as is sometimes attempted when they become agricultural pests. J. T. displayed great finesse in cracking and eating the eggs she could steal from the natives' baskets, a skill which betokened nest-robbing proclivities in days of freedom

J. T. makes herself at home for Thanksgiving Day luncheon in the high grass on the southern slope of Mount Elgon. Human food is quite to the monkey folk's liking. In fact what constitutes their major vice in the eyes of the settlers of British East Africa is the propensity for raiding grain fields and orchards in large bands. They feast on maize or fruit until they are "stuffed" and then cram their elastic cheek pouches for future use; but what is worse, they always destroy in their foraging far more than they eat

Stopping to pose for their photographs while crossing a small stream on Mount Kenia. Although here perched high and dry on Allie's shoulder, J. T. had by no means any dislike for water; monkeys are fastidious bathers, keeping both themselves and their babies scrupulously clean. If necessary, they can, in all probability, even swim a stream

anyone, and at once bit a hole in Mr. Stephenson's mosquito boot.

We put a collar on her and tied her to the tent pole. She looked us right in the eye and told us what she would do to us if we should come within reach. Not that she made any sound. She did her talking by making faces at us and by dashing at us as she ran the length of her string. And she pursed her lips. I never saw another monkey do that. Later she would often do it when she kissed the companion monkey we had for her, or when anything pleased her very much, or after she and I became good chums and she hugged me in human fashion, opening her mouth in a funny little way to express her feeling.

She was so pretty and saucy that when we left the Tana River camp three or four days later, we decided to take her along with us. She rode on top of a porter's load. When we got into a new camp that night, she was so tired and hungry that she jumped on to my lap—her first acceptance of friendship—and sat there and ate a banana. I was a little afraid of her, but her teeth were so small then that she could not have injured me if she had attempted to bite.[1] After a while I began to brush her hair tentatively. She made a face at me; then she decided she rather liked the brushing—and after that she expected it every day.

From this camp we went up into the foothills of Mount Kenia after elephants. We did not pay much attention to J. T. during the first part of the trip, but she gradually impressed herself upon us. Monkeys seem to have individuality and I think it was J. T.'s personality which finally attracted us: she was so intelligent and so thoroughly able to take her own part.

We were all busy at camp, however, and left her alone with the black boys a good deal. At first I used to tie her to the tent pole, but she acted so afraid I made a little house for her; still she seemed terrified to death and would go up on the table and not sit on the floor. She slept on the table at night and sounds outside the tent seemed to terrify her. I soon remembered that she was used to living high in the trees, beyond reach of leopards and the many other ground-prowling enemies of her race. J. T. had no considerable generalized sense of fear; she was particularly courageous, and later, when she came to depend on my friendliness, from the vantage place of my lap she was afraid of nothing, and would defy anybody. She had definite fears, however, a few instinctive and others which developed from particular experiences.

Her instinctive fear was always very great during a thunderstorm. She would get under my raincoat, hold it tight together so that she could not see the lightning, and not come out until the storm was over. The storms in British East Africa are appalling in their intensity. Sometimes they come up so quickly that you can hear the rain long before you can see it. Particularly in the forest a wall of spray like that of Niagara would come up over the tree tops with a roar so loud that we would have to shout to each other and then could barely hear a voice above the storm. Such a storm would sweep everything before it, and if it came in the night the porters would rush to our tent and hang on to the tent ropes and see that the big trench dug around the tent to carry off the water had not filled up with débris washed or blown into it. I often wondered what the little wild monkeys did in such a storm. In the Uganda forest, for instance, there are so many dead trees and dead branches that the danger for the forest animals during storms must be very great.

When we went back to Nairobi, J. T.

[1] When their fangs begin to get long, these monkeys can give a very nasty bite. The teeth of the monkeys have a cutting edge like a saw, and monkeys of this species fight a good deal among themselves and even in play will bite each other.

went with us, again riding on a porter's load. I remember that we had made a very long march when we stopped for lunch, and the porter put her down, stuck a spear in the ground near our table and tied her to it. I can just see how she sat beside this spear and put her arm around it, almost falling over from fatigue and sleepiness, but squealing and trying to eat a piece of bread as she squealed and nodded.

It was after this that we decided to get a little black boy to take care of her. So Allie became her bodyguard. She rode from camp to camp on his shoulder or up on top of his head, and he always fed her. When we found that the sun and wind affected her eyes and made her sick on the long marches (for she was used to life in the shadow of green trees), we got an umbrella for her. Allie would carry the umbrella over her head—or she would sit on his head and help carry the umbrella herself.

When we went on to the Uasin Gishu Plateau, J. T. traveled with us by train. The Indian station masters, when a train pulls in, have the habit of following along the running board at the side of the train and looking in at the windows. One morning when one of these station masters stuck his head over the blind into our compartment, J. T., who was awake, resented the intrusion and promptly slapped his face. Her movements were always like lightning and the man was taken completely by surprise. He demanded her ticket. We laughingly referred him to the station master at Nairobi, and he must have written to him for when we came back to Uganda we were asked to buy a ticket for her or to put her in the baggage car. We observed, however, that he was careful not to put his head over the blind of our compartment.

J. T. went with us to Uganda and followed the elephants with us. She went to the top of Mount Elgon and Mount Kenia. She suffered from the cold at high altitudes and on Mount Kenia got mountain sickness and we had to send her back.

As a rule the black boy, with J. T. on his shoulder, followed after us. That is how it happened that in Uganda the elephants nearly got her. Allie heard the shooting and came up on the wrong side; the elephant happened to be one which had already charged us twice. The third time he came rushing on with a great branch in his trunk, but instead of charging straight at us, he went off to one side, and Mr. Akeley killed him just before he reached Allie and J. T. Mr. Akeley did not know they were in danger until he went over to the elephant after killing it and found the boy and the monkey fallen into a clump of grass and bushes from fright. J. T. did not like the forest life. Along the banks of the Tana River where she lived, the tree growth is never dense forest but merely open scrub.

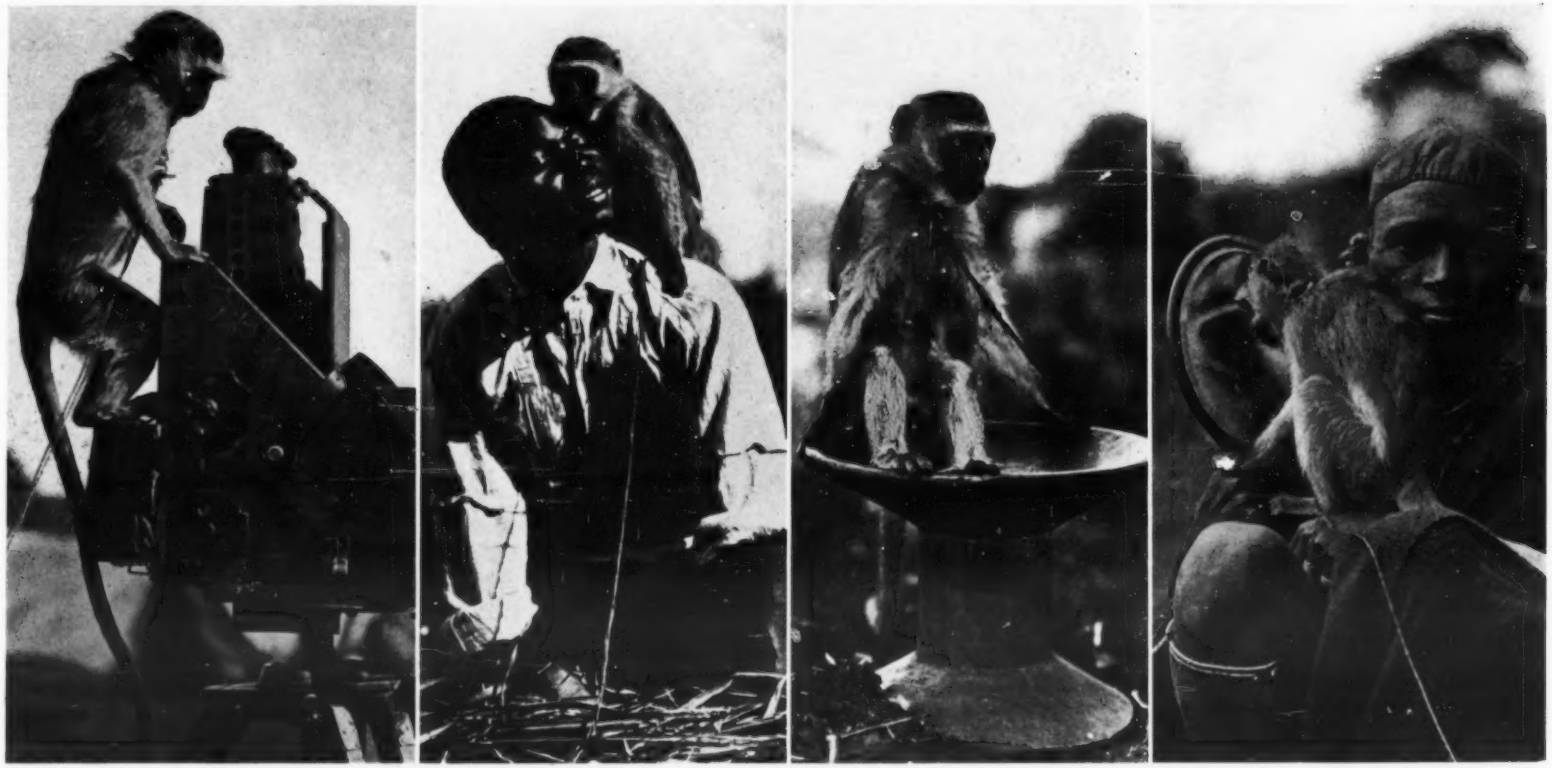
We took her with us also across the Budango Forest and there she was very much frightened by the chimpanzees. We wanted to study these chimpanzees and get photographs of them, so treed two or three troops. But the big creatures broke huge branches from the trees and thrust them at us, all the while screaming horribly. "Baldy's" roar and scream in the monkey house at the Zoölogical Park in New York had not seemed one half so terrifying as was this screaming of the wild chimpanzees in the forest.

By this time J. T. had become an experienced traveler. She had dropped into our ways without any training. We never punished her and in fact never tried in any way to train her, being interested to see what she would do by just being with us. She learned things quickly and remembered. She learned most quickly about the things she liked best. She liked to take a bath, for instance. Judging from her great fondness for water I think the troops of

J. T. JR. AND SOME OF HER FRIENDS

J. T. impatiently frets while Billy Duiker, a baby antelope, gets his breakfast first. What disturbed J. T. was not so much that she had to wait for something to eat (she never outgrew her fondness for the nursing bottle) as that she was jealous at seeing Billy getting the attention she considered her right. Monkeys very strongly express their emotions, of which not the least is jealousy and its accompanying anger. J. T. took out these emotions on us by jumping the length of her chain and making faces. She readily made friends with other animals but she nevertheless expected to maintain a monopoly on our affections

This dog, after following us into camp and making J. T.'s acquaintance, refused to be separated from her. In spite of many and various friends, however, J. T. must have missed the companionship of her own gregarious kind



CURIOSITY; PLAY; WEARINESS; COMPANIONSHIP

J. T. is here photographed in the various occupations of investigating a Graflex camera, romping with one of the boys, resting on a chief's stool after a long march, and intent upon her reflection in a mirror. The mirror was one of J. T.'s constant playthings. I am inclined to think that she recognized the image as her own; at least she certainly knew it as one of her kind. She always slept with her face against the glass

IT WAS ALWAYS WORTH WHILE TO INVESTIGATE THIS POCKET

Whenever Bill went out with the hunt, he picked up something he knew would be of interest to J. T. and, on his return to camp, she lost no time in investigating the particular pocket in which he always put it. Monkeys acquire habits of this kind very quickly, a fact which is one of the clearest indications of their mental superiority over other animals.

Often, when talking at night around the fire in our African camp, we deplored the necessity that any of the jungle wild creatures should be taken to the unnatural conditions and homesickness of captivity. Think what must be the unhappiness of these intelligent monkeys, for instance, when shut up in little narrow cages even in a well-cared-for zoological park—after having lived a life of freedom in the wind and sunshine at the tops of trees

monkeys of this species on the Tana River must have bathing places in the river despite their fear of crocodiles. In camp the black boy would bring her tub of water into the tent every day. She liked the water very hot and would always put her hand in to test the temperature before she jumped in. If it was too hot she would fly at the boy, and if too cold she would do the same thing. The boy would try to fool her sometimes by making it too hot or too cold, but she was not to be trifled with. She would play with the soap like a child, and would get into the water many times, jumping about and playing between times. When she had had enough she would go out on top of the tent and sit in the sun.

From the specimens that we see in the zoölogical parks we might judge that monkeys are not always as cleanly creatures as they are in nature. Monkeys of this species are very cleanly. They have a little woodsy odor, something like that of a squirrel, but their bodies are perfectly clean when they are caught wild. J. T. never could endure having her hands dirty, and if she got her fingers even wet while eating she would dry them immediately. The poor little monkeys in the zoölogical park get tired of trying to keep their hands clean. Their habit of extreme cleanliness, as well as their keen eyesight, is evidenced by their continually picking at their fur—which people interpret as meaning that they always have vermin on them. But J. T. would sit down and pick off from her fur every little speck of dust, atoms so small that they would not be noticeable to my eyes. When playing with other monkeys, she would pick off the dust from their fur, and when she and I became friendly it was her delight to try to discover tiny bits of dust on my hair —even my eyelashes and eyebrows would get the same treatment if I allowed it.

The powerful vision of this type of monkey was shown continually in J. T.'s behavior. She was very farsighted. On one occasion when she was with Mr. Stephenson and Mr. Akeley at the camp, she attracted their attention by constantly looking off toward one point in the forest. They could see nothing, but on taking the field glasses discovered that I was coming out of the forest with my black boy at just that point more than a mile distant.

Her vision for small objects, as well as her delicate sense of touch, was shown in the care with which she would rip fine stitches from cloth. Sometimes when I was sewing or reading and wanted to get rid of her I would give her some old garment and she would rip out the stitches without tearing a single bit of it—also if not interrupted she would rip the lace from the window curtains to amuse herself.

I am afraid she often was lonesome, in spite of the dolls she loved and slept with, the many comforts of her life, and her strong attachment for us. Gregarious life is instinctive in the blood of this species of monkey. But we seldom could have other monkeys for her to play with for more than a week or two at a time, because we never stayed very long at any one camp. At a camp in Uganda we kept a baby red *Colobus* monkey, but the little thing became so fond of J. T.'s black boy that it would cry and mourn whenever the boy left it. On Mount Kenia we brought into camp a female green monkey, a species in which the fur is tipped with yellowish green, in the manner of "tipped fox." While we had her she gave birth to a baby, but it was dead, and she would only turn her head away and not look at anyone, and hid the little dead baby by covering it with leaves and grass in the cage.

"Patch" proved J. T.'s best companion. But he did not enter her life until we were on the boat coming back to America. He was a little yellow mon-

key that was being brought over from South Africa. The passenger who owned him left the boat at Port Said but could not pay the fare for the monkey, which consequently fell into the hands of the captain. It was just after Patch had been down in the coalhole that J. T. first saw him, but she immediately put her arms around him, so the captain said she might have him. After that Patch and J. T. were inseparable.

That monkeys may be friendly with certain other creatures, as well as devoted to the companionship of their own kind, J. T. proved to us many times. She had two or three dog friends while she was in Africa. In Uganda a native African dog followed her into camp. One night this dog gave birth to a litter of pups just outside the tent. Early in the morning J. T. heard the puppies and gave a purring sound while she lifted up the blind of the tent to look out. On seeing her the dog turned over and licked her face and J. T. put out her hand and touched the dog, which then licked J. T.'s hand —and J. T. continued to sit there as if admiring the puppies. We took them out by the camp fire and J. T. went over to them there and softly put her hand on one of them and sat there and watched them. She always tried to kill a little bird or other young thing, but these puppies she did not attempt to hurt.

During Mr. Akeley's convalescence from the almost fatal mauling he had suffered from an elephant, J. T. was his faithful entertainer. Never before or since has she given such undivided attention to amusing one person, and she was a source of great help and cheer throughout the trying weeks

She was always greatly interested in the little black babies of the natives. She would ignore the mother and go straight to the baby, and sit down close beside it and look at it. If allowed, she would kiss it, pursing her lips, and opening her mouth and pressing it against the baby's face.

Of all her playthings and companions, none perhaps proved a source of more constant comfort to her than her mirror. What the workings of her mind were it was difficult to tell, but her reflection evidently stood to her as that of her own kind and as company. After gazing steadily into the mirror for some time at her own serious eyes, she would look back of the mirror as if searching for the monkey she saw in it. She always slept with her face against her mirror. In addition to this companionship, the mirror afforded her unending amusement and she was very clever in handling it and turning it slowly back and forth from side to side while she watched the changing reflections in it.

It was inevitable that her energy and cheer should infect the camp life and make us all very much attached to her. She often indulged in swift rough play and, from the human way of looking at

things, was often mischievous. At one time we had a rooster and some chickens; it was her special delight to chase these around and around the tent and through the porter's yard—until one day the rooster chased her in return and frightened her out of her wits. The cook of the expedition was tormented continually by various tricks she developed. She would steal into the kitchen and, if he were out, would unhook every pot and pan from the roof where he kept them hanging, and so quickly that he could not reach her until the mischief was done. Many a time I had to mollify his temper by giving him another supply of tobacco when she had carried his away.

It was no unusual thing to see the black boys roll on the grass and howl at her antics, especially when she ate an egg or a locust. The locusts were two or three inches long and very strong, yet she was expert in catching them and holding them tightly by the legs so that they could not kick. The monkeys of this species like meat as well as fruit, and they not only eat insects and spiders but also, no doubt, kill the young of many small mammals besides robbing many a bird's nest. The natives brought hens' eggs into the camp to sell and J. T. would steal an egg whenever she could get the chance and go up on the roof of the tent with it. There, with the egg held firmly in her hands, she would crack the top and lick the fluid as it ran down the side. If the fluid ran a little too fast, she would get very excited, stand on one leg, and continually jump into some new position more ludicrous than the one before in her effort to keep the egg from getting on her fur.

Finally came the time at a Mount Kenia camp when Mr. Akeley had been mauled by an elephant and spent difficult weeks in recovering from his injuries. He used to get worried and become despondent because he was convalescing slowly and his work was making no progress. Sometimes when I saw the worry coming into his face, I tied J. T. to the foot of the cot, and wonderful playtimes would follow. She would pretend to be terribly frightened at any slightest movement of the bed covering and would jump wildly up in air like a playing kitten; she would never tire of playing hide and seek; she would watch demurely for an opportunity and snatch his pipe or tobacco and hide them at the foot of the cot out of his reach. When he was able to walk down the path from the tent she was not content unless she could ride on his shoulder; then she would jump down and play hide and seek from the grass, jumping out at him from unexpected places. She had never played quite in this way before and never did it afterward, and it seemed almost strange to us that she should help us out and cheer us when we needed the help and cheer so sorely.

ON THE BORDER OF THE EVERGLADES; PELICAN LAKE FIVE YEARS AGO

Against the sky line a solitary cypress spread its branches above the dense growth of pond apple trees (*Annona*), which were overgrown with moon vine (*Calonyction*), its multitude of blossoms showing as white dots in the picture. Near the shore grew bulrushes (*Scirpus*) and maiden cane (*Panicum*) and, at the water's edge, upright ranks of arrowhead leaves (*Sagittaria*) above a zone of pale green water lettuce (*Pistia*). Water hyacinth (*Piaropus*) also grew luxuriantly here, both along the shore and in floating islands in deeper water. The photograph shows the leaves with their oddly inflated stalks reflected in the lake's surface.

When cruising in Pelican Lake in 1913, both in sunshine and by moonlight, we found it one of the most beautiful spots we had ever seen. Also the forests of the hammocks were immense heron rookeries, and the waters abounded in alligators. Today the whole region is a waste, showing miles of bare lake bottom and acres of coarse weeds.

For many miles around Lake Okeechobee there is neither ordinary soil nor rock. Vegetation grows directly from a floor of "peat" or humus formed through the gradual decomposition of vegetable matter. Whether the area be the bottom of the drained lake or the dry land of a cleared hammock, it is everywhere only "peat." Near Moorehaven this peat formation resembles a gigantic sponge, trembling under foot with each step, yet the dwellings and concrete walks of the town are built upon it

Narrative of a Cruise to Lake Okeechobee

DESCRIPTION OF A LAND OF "PEAT," WHERE THERE IS NEITHER SOIL NOR ROCK, EVEN TOWNS BEING BUILT ON THE TREMBLING SPONGE OF VEGETATION.—NEED FOR GOVERNMENT PROTECTION OF SELECTED AREAS BEFORE THE FLORA OF THIS REGION, NOWHERE DUPLICATED IN OUR COUNTRY, CEASES TO EXIST

By JOHN KUNKEL SMALL

Head Curator of the Museums and Herbarium of the New York Botanical Garden

THE words "Everglades!" "Okeechobee!" "Big Cypress!" carry great fascination, particularly to the naturalist. Until recent years the regions represented by these names held many mysteries in their unexplored depths. Some of the mysteries have yielded, while others remain to be solved.

In continuation of a botanical exploration of southern Florida, I set out May 5, 1917, on a collecting trip to the Lake Okeechobee region in the Everglades. Wonderful changes have taken place in southern Florida within the last decade or two. Previous to that time anything in the way of modern transportation was wanting. What was then a matter of weeks is now a matter of hours. I had returned to Miami May 4 from a collecting trip to Big Pine Key and Key West, a distance in latitude of nearly one hundred miles, and the night of May 5 found me in the Everglades nearly one hundred miles farther north. Our party left Buena Vista early in the forenoon, on board the "Barbee," generously fitted out by Mr. Charles Deering. Aboard were Paul Matthaus, captain; Victor Soar, horticulturist; Charles T. Simpson, conchologist; Leban Bethel, crew and cook; and the writer. This classification, however, did not hold good at all times. It was a very democratic party: sometimes all members were officers, at other times they were all crew.

We were forced to go to Lake Okeechobee by way of Fort Lauderdale, as the Miami Canal was still securely blocked by politics and finance. (See map, page 686.) All went well until we entered New River Sound, a very beautiful spot in the inland waterway —but also a place where the unexpected always seems to happen. As we were about to pass from the sound into Lake Mabel, a severe electric storm accompanied by drenching rain and high wind suddenly broke upon us. We groped about until the close proximity of a bolt of lightning and an overpowering quantity of ozone brought us to our senses and we decided to throw over an anchor and wait.

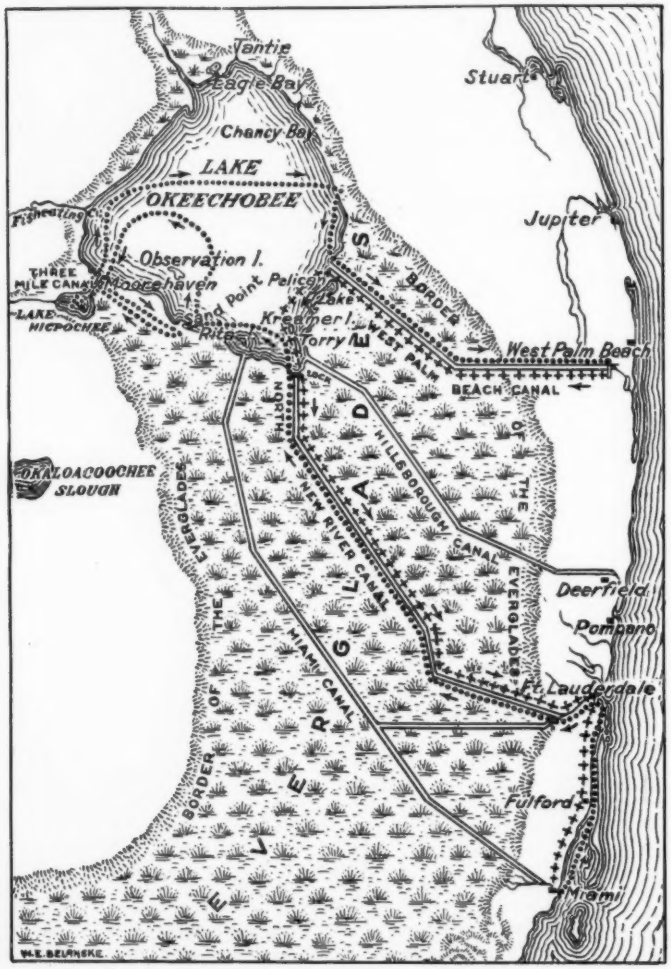
After the storm passed, we proceeded into Lake Mabel, passed Fort Lauderdale, and went up to the source of New River at the rim of the Everglades and entered the North New River Canal. The water in the canal was exceptionally low owing to the prolonged drought. While entering the first lock the keel of the "Barbee" caught on the concrete sill amidships and there we hung, so nicely balanced that we were unable to move the boat forward or backward. We had to wait until the water rose sufficiently to float us,—perchance some boat ahead of us had gone through a lock many miles nearer the lake, or the tide may have risen.

Our real troubles, however, were only beginning. Again the low water and an imperfectly dredged channel delayed us. Before proceeding far we

were compelled to reduce our speed to a minimum, for the stout bronze shoe on the keel of the "Barbee" began to touch projecting rocks along the bottom of the canal, and for a distance of about forty miles we scraped rock after rock, causing as much friction on our nerves as on the shoe.

Had it not been for the ingenuity of our captain we should have had to abandon the cruise. He created a ballast by pulling our rowboat aboard, setting it across the bows of the "Barbee," and filling it with water. This weighed down the bows, and thus elevated the stern with the propeller high enough to allow the boat to float safely above the rocky bottom. In order to counterbalance the delays and the loss of time caused by the reduced speed, we ran well into the night. Of course, plant collecting suffered neglect, but, fortunately, I had collected rather thoroughly along the banks of this canal in the fall of 1913.

After passing through the second lock, the sailing was smoother—at least



The southern part of peninsular Florida, showing about 120 miles of Atlantic coast, the narrow strip of high land adjacent to this coast, the area of the "Big Cypress" on the west, and the "Everglades" and Lake Okeechobee between.—The Everglades represent a wet prairie, partly dry in winter, submerged in summer, treeless except for the higher hammocks, like islands, along or near the borders, and the dense hammock surrounding Okeechobee (25 ft. above sea level). The region is impenetrable to travel, with no natural channels for navigation; hence the canals, four water highways from the coast across to Lake Okeechobee. When the channel is opened westward from Three Mile Canal and Lake Hicpochee, the last link will be completed in a water route across this part of Florida.

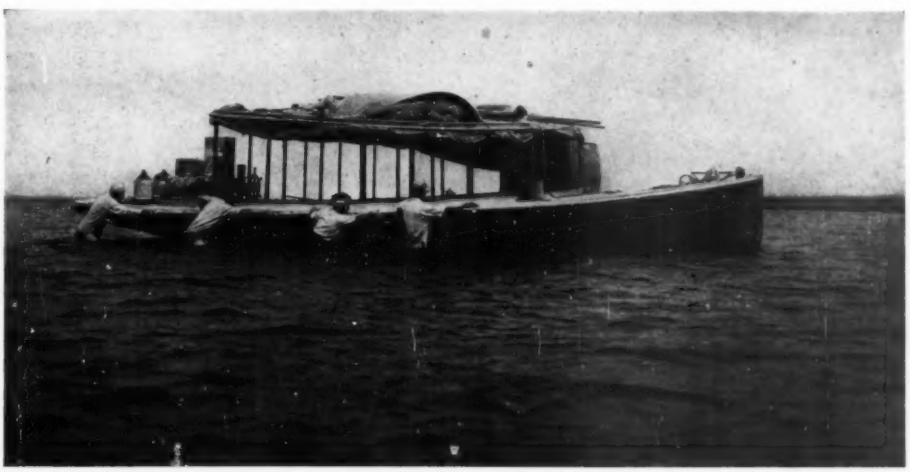
The expedition went to Lake Okeechobee from Miami by way of Fort Lauderdale, as the Miami Canal is not completed; but it found that North New River Canal needs to be deepened. The expedition's boat was able to keep its propeller from scraping the rocky bottom only by means of a ballast on the bow. Return was attempted unsuccessfully by way of the West Palm Beach Canal.

At least parts of the Everglade and Lake Okeechobee regions should be made state or federal reservations for the benefit of future generations of Americans. Florida is behind other states of the Union in not having reserved any of its forests or other natural features (except Royal Palm Hammock, together with some of the adjacent Everglades, called "Royal Palm State Park")

Looking into Lake Okeechobee from West Palm Beach Canal (see map, page 686), which has been dredged through a heavy sand ridge thrown up along this shore by westerly winds. Pond apple trees may be seen at the sides of the canal, and the tops of the cypress trees facing the lake are visible, rising above the pond apples

as far as the bottom of the canal was concerned. This lock is not a real one, but an improvised and homemade affair, and really a wonder! Each gate consisted of a score of separate pieces of planking which had to be handled piece by piece when the gates were opened and closed. But, fortunately, it dammed up enough water to float a boat of three or four feet draft and thus keep it from striking on the bottom of the canal. The lock at the edge of the lake is in the same condition as in 1913—that is, the place where it is to be is marked out on the canal banks.

Upon entering the lake we were lost. The water level was from five to seven feet lower than it formerly had been,



Defying alligators and giant catfish in the dark waters, we gradually maneuvered the boat into a deeper channel a quarter of a mile to the northward. The expedition's party on the "Barbee" was democratic, sometimes all were officers—and sometimes all were crew, as when the boat struck this bank of putty-like mud near Kreamer Island. The "Barbee" was generously outfitted for the expedition by Mr. Charles Deering, of Miami. Besides the captain and a man who acted as crew and cook, there were three scientists aboard, namely, a conchologist, a horticulturist, and a botanist

Pond apple trees, and water hyacinths set with their beautiful spikes of blue flowers, clothed the margin of Pelican Lake for a distance of many miles in 1913. Water hyacinth attained here a most extraordinary growth, sometimes three or four feet in height, a size greater than ever recorded elsewhere. Whether the species is native in Lake Okeechobee or an introduction from South America, can probably never be decided

Cypress trees (*Taxodium*) that fringe the hammock, their gray trunks and light green foliage outlined against a background of various broad-leaved trees. This is on the crest of the sand ridge just above the wide beach of the eastern shore. Land and vegetation are quite different here from farther south. Only a few small grasses and sedges grow on the sandy shore. Indeed, from certain plants found, it was thought that this was once a seacoast

and instead of an uninterrupted expanse of water, great areas of lake bottom extended as far as the eye could see, with uncertain channels running here and there between them. We finally found our way into the lake between Kreamer Island and the southern shore and headed for Rita Island. On account of the low state of the water we passed the northern side of the latter island, and headed for Sand Point. Thence we attempted to pass between Observation Island and the mainland, but were confronted by a barrier in the form of a reef[1] of jagged rock extending from the island to the southern shore of the lake. It proved to be a ridge of rock placed nearly north and south at the southwestern corner of the lake, with Observation Island built up on the higher part. As the water stood at that time, the reef extended just under the surface for about nine miles north of Observation Island.

Darkness fell as we arrived abreast of Observation Island. We were bent on reaching the newly established settlement of Moorehaven, which is situated at the mouth of Three Mile Canal, a dredged channel connecting Lake Okeechobee with Lake Hicpochee. On the eastern side of Observation Island we were about twelve miles, in a direct line, from Moorehaven; but in order to reach it we had to sail many miles to the north to get around the end of the reef already described. Several times we imagined we saw the lights of the settlement in the distance, and subsequently learned that our observations were correct. Having been informed that there was a beacon at the northern end of the reef, we proceeded northward in the darkness, keeping along the edge of the reef by continual soundings. The beacon was supposed to be lighted at night, but after proceeding northward for a distance of nine miles or more no beacon light hove in sight, and the night was too dark to see the beacon itself unless we had happened to run quite close to it. Just how many times we saw the light of that beacon in imagination it would not be safe to record. When we thought we were fully twelve miles north of Observation Island, the lights of Moorehaven were very evident in the distance, and we could distinguish the outline of the western shore of the lake above Fisheating Creek. Assuming that we had in some way succeeded in rounding the end of the reef, or at least that we were far enough to the northward to round it, we decided to run on a southwesterly course, which would take us to the mouth of a canal recently dredged in the lake for the distance of about eight miles northward of the mouth of the old Three Mile Canal. Successive attempts were made but each resulted only in finding shoal water. Finally we seemed to get into deeper water. We increased our speed, when, to our surprise, the stout keel of the "Barbee" struck a rock. The boat jumped the rock and came down twice on other rocks. We all watched to see the water come in through a hole somewhere in the hull; but none appeared. This incident, however, determined us to spend the rest of the night at anchor.

In the morning we found the much sought for beacon in the distance. After we rounded it, we reached the northern end of the canal without incident, except for an hour's delay on some mud banks during the regular morning squall and rainstorm. At the entrance to the canal our real troubles in navigation began again. Up to within several hundred feet of the canal was deep water and within the canal was deep water, but the bar of hard sand at the entrance was covered with only one or two feet of water.

An old boatman within the canal was watching for the stern-wheeled steamer "Osceola," which was three days over-

[1] This reef is the one I was on the lookout for in 1913, at which time we evidently sailed over it twice without observing it. *Journal of the New York Botanical Garden*, 15: 76. 1914.

due on a thirty mile run across the northern part of the lake. As we lay piled up on the sand bar the boatman told us that it was possible to get a boat across the bar by means of the proper combination of time and labor. So we began our task. First we resorted to our water ballast again, placed the rowboat across the bows and filled it with water. Then the engine was set going at full speed and all hands jumped overboard. By pushing and pulling and lifting, the "Barbee" was moved inch by inch, and after an hour or two of this violent exercise on our part she glided into the canal. Everybody clambered aboard, and we were off on the final tangent of our course to Moorehaven.

We had finally reached an extraordinary portion of the earth's surface. There was present neither soil nor rock! All the dry land was built up of pure humus. We were in a land of "peat." For many miles in all directions there was nothing but vegetable matter in all degrees of decomposition, derived from both herbaceous and woody plants. This accumulation of "peat" extends around Lake Okeechobee. It is interrupted and partly obscured just back of the eastern shore by a sand ridge which represents the one-time bottom of the lake, blown out and piled up by strong westerly winds. At the southern and southwestern side the accumulation of peat is more massive than elsewhere, varying from three to fifteen feet in depth—or even more. Although this form of decayed vegetable matter is spoken of as "peat," the basis of true peat, sphagnum and the usual associated plants, does not enter into its composition. Furthermore, it is evidently not as acid as sphagnum peat, for all or nearly all cultivated crops may be grown on it in its virgin condition. No preliminary preparation is necessary, except the loosening up of the surface so that seeds may be planted.

The natural plant covering is the hardwood growth known in the southern United States as "hammock." The trees consist principally of cypress (*Taxodium*), strangling-fig (*Ficus*), pond apple (*Annona*), pop ash (*Fraxinus*), and elder (*Sambucus*). The growth is impenetrable except with the aid of a machete.

From the vicinity of Moorehaven around the southern side of the lake, the "peat" formation is remarkable. It resembles a gigantic sponge and walking on it is extremely tiresome. The mass trembles under foot with each step; yet, the concrete sidewalks, the houses, and other structures in Moorehaven are built directly on it.

We tied up to the bank of the Three Mile Canal in town for a time, then proceeded slowly down to Lake Hicpochee, where the canal terminates. This lake is a beautiful body of water to behold, with narrow and wide dimensions of about three and five miles respectively. It is the source of the Caloosahatchee River, and consequently one of the links in the chain of the transpeninsular waterway. We navigated our boat to about the center of the lake without difficulty, but out there we ran into a "Slough of Despond" of the most discouraging kind. This was a mass of black "gruel" of just the proper consistency to prevent the "Barbee" from moving forward or backward. To make things worse we could not move the boat by hand, as a pole pushed into the black mass would sink to an indefinite depth without appreciable resistance.

The propeller churned up this ink-black loblolly, with the aquatic plants, water moccasins, fish, and what not, without making progress. But a violent electric storm with high wind came to our assistance and blew us into a gruel of less dense consistency, and by degrees we drifted into deeper water, whence we were able to make our way back to the mouth of the canal. After

this experience we realized the force of the information which had been given us by an old boatman as we entered the canal north of Moorehaven. He told us we could not navigate the upper waters of the Caloosahatchee River on a shingle! We do not think he exaggerated.

Once back to the canal, we set to work gathering live plants and herbarium specimens. It was interesting collecting ground, not only on account of the various strange plants, but also because of the uncertainty of the footing. Of course, walking was out of the question except where the dredge had dug into the bottom of the lake below the "peat" and thrown out some of the sand underlying the decayed vegetable matter. Even on this coating of sand one could not tell when he would break through and, in the twinkling of an eye, find himself waist deep or up to the armpits in the black loblolly—as one member of our party can testify.

The intervening territory between Lake Hicpochee and Lake Okeechobee is a collector's paradise. Naturally, water plants and marsh plants are much in evidence. In the lower ground arrowheads (*Sagittaria*), pickerel weed (*Pontederia*), pennyworts (*Hydrocotyle*), persicarias (*Persicaria*), pond weeds (*Potamogeton*), eelgrass (*Vallisneria*), and naiads (*Naias*) predominate. On the higher land, wild cucumber (*Melothria*) was rampant, while two kinds of mallows dominated the landscape; curiously enough these plants of closely related genera did not occur much intermixed. In some places, acres of open land as far as the eye could see, were covered with an almost pure growth of a species of *Kosteletzkya* having rose-purple flowers, while at other places, areas equal in extent were similarly clothed with a rose mallow (*Hibiscus*) which bears myriads of large light-pink flowers.

We returned with the "Barbee" to the Moorehaven public dock for the night, and the following morning set out afoot for an examination of the country between Moorehaven and Sand Point, about a dozen miles eastward on the southern shore of the lake and south of Observation Island. As we proceeded, the wonderful phenomena of the country gradually unfolded themselves. The natural features of that region are duplicated nowhere else, and unfortunately they are fast being destroyed. After about two years of the progress of civilization only remnants of the once unique pond apple hammocks and other plant associations are left. Moreover, we found many parts of the country afire. Over a large area fire had eaten into the "peat," and numerous subterranean fires were revealed by the smoke which came up through craters where the substratum had burned away and the superimposed "peat" and ashes had caved in. The same member of our party who the day before had fallen into the loblolly of Lake Hicpochee, fell into one of these craters and was partly buried in the hot ashes. Although this gentleman had never, either by word of mouth or action, led any of us to suspect that he believed in mediæval theology, he himself was now thoroughly convinced that if there was any place to be fallen into he was the predestinated man.

Fires were so numerous that the region might well be designated "The Land of a Thousand Smokes."[1] We had smelled the smoke that drifted eastward beyond the middle of the lake during the day and night we were hunting for the lightless beacon.

We passed through sections of virgin primeval forest, as well as through regions partly denuded and regions wholly denuded of all natural vegetation; thus we were treated to a panoramic view of all the stages of devastation. Following the final stage of destruction were

[1] With apologies to Professor Robert F. Griggs in *The National Geographic Magazine* for February, 1918.

ON THE PROTECTED EASTERN SHORE OF OKEECHOBEE

Hammock of this character once bounded the whole eastern shore of Okeechobee. Frosts, which sometimes devastate the western shores, do not touch the eastern, because the thirty-mile stretch of the waters of the lake tempers the prevailing westerly winds. In this sheltered region, therefore, the flora is more varied and of greater luxuriance, and harbors more tropical elements, both terrestrial and epiphytic. The hammock floor supports especially beautiful and abundant growths of ferns and fern allies of tropical nature. Little of such hammock is now left, however, and encroaching civilization and cultivation of the region for crops soon will erase the last vestige, losing to science, and to the people, the rich native plant life of this isolated part of the United States

will erase the last vestige, losing to science, and to the people, the rich native plant life of this isolated part of the United States
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One step in the process of making agricultural land out of dense hammock on the peaty shore of Lake Okeechobee (south side of trail between Moorehaven and Sand Point)

Denuded of its luxuriant vegetation, the spongy "peat," from three to fifteen feet deep, needs little ploughing to prepare it for planting

This shows part of a potato field of 200 acres. The "peat," without the use of any fertilizer, may readily yield each year two or three harvests of truck crops, such as potatoes, beans, onions, tomatoes, and peanuts

fields of potatoes, tomatoes, onions, and other vegetables, hundreds of acres in extent.

In some places pond apple trees and ferns existed in association to the exclusion of nearly all other woody and herbaceous vegetation. Other areas were densely clothed with an impenetrable growth of southern elder, which bears flowers and fruits continuously throughout the year. Here and there were groves of the pop ash (*Fraxinus*), or of the live oak (*Quercus*). The cypress was represented usually by isolated trees. This cypress, for some reason as yet unexplained, occurred in two forms. If the tree trunk was only slightly or not at all buttressed, very numerous "knees" were produced from the roots in the neighborhood of the trunk; while if the trees had developed prominently buttressed trunks, very few "knees" or none at all appeared. Another interesting phenomenon observed was the association of the strangling fig and the cypress. Not a tree of the cypress was observed that did not have accompanying it a strangling fig. This phenomenon was particularly conspicuous as the cypress was devoid of its foliage and the fig was in full leaf.

Imagine a weed twelve feet high, with a stem a foot across! The water hemp or "careless" (*Acnida*) is a pigweed which quickly takes possession of the exposed bottom of Lake Okeechobee or of cleared hammock. It attains its giant growth in a single season, producing some wood and reaching the proportions of a small tree

A few miles east of the settlement we unexpectedly met a friend with a horse and wagon, which he kindly turned over to us for the day. We were thus relieved from carrying our burdens, but did not tax the horse with our own additional weight, as he seemed to be more fatigued than we by walking in the spongy peat.

The lowering of the water in the lake had naturally lowered the water table in the "peat," which normally contained a very large percentage of water. Being deprived of this moisture, the "peat" had shrunk, and in many instances the root systems of the trees were clearly exposed, particularly in the case of the cypress, where the connected system of roots and "knees" was beautifully demonstrated.

The decayed vegetable matter of this region forms a "soil" in which the most rapid growth takes place, and several crops of cultivated plants may be grown

and harvested each year without the use of any kind of fertilizer. In many of the clearings intended for the planting of cultivated crops, annual weeds had appeared and were thriving. One native weedlike plant was conspicuous, a pigweed, botanically known as *Acnida* and popularly as "careless." This annual is a giant among weeds. It produces in one season a stem often more than twelve feet high and a foot in diameter. It is usually much branched, and bears myriads of flowers.

Soil, aside from mere decayed vegetable matter, however, was nowhere in evidence. We passed over areas of what had been formerly lake bottom, as well as the cleared forest lands, and found nothing but spongy "peat."

Later in the afternoon we collected on the prairie-like regions west of Moorehaven and also in the open places in and about the settlement, which probably a year or two before had been covered with saw grass. It was interesting to find how the garden flowers which the settlers had brought in the previous year had taken possession of this untamed soil. Phlox (*Phlox Drummondii*), evening primroses (*Raimannia Drummondii, Raimannia laciniata*), blanket flower (*Gaillardia*), zinnia (*Crassina*), and the flower-of-an-hour (*Trionum*), all grew with greater luxuriance in this wild state than I have ever seen them in cultivation. As a result of growing crops, there had escaped from the fields alfalfa (*Medicago sativa*), tumble-mustard (*Norta altissima*), cowpea (*Vigna sinensis*), beggar-ticks (*Meibomia purpurea*), and several large grasses.

Having used up the time our schedule allowed for our work here, we reluctantly started back through the Moorehaven canal for Lake Okeechobee. In dredging this canal, which is really a channel in the lake, there have been thrown up high banks of a mixture of white siliceous sand and sea shells, a deposit that was formed when the region was the bottom of an ancient sea. Although this material did not seem to have any available plant food in its

Compare this picture of the shores of Pelican Lake in 1917 with the photograph on page 684, showing the same area five years before (1913). The hammock has been destroyed, the water has receded, the humus, dried and cracked, supports only a rank growth of coarse weeds. Vast tracts in this region will be devoted to agriculture, but certain selected areas of unique interest and value should be conserved under Government control

CYPRESS STRONGLY BUTTRESSED AND WITHOUT KNEES

Cypress trees about Okeechobee occur in two very different forms, each the result of an effort on the part of the tree, apparently, to obtain a stable anchorage in the spongy humus for the great weight of top growth. In one form stability is acquired through a cone-shaped growth of trunk, broad and buttressed below. In the other, small woody protuberances called "knees" are thrown up by the roots. Cypress in the Okeechobee region is either buttressed or kneed, rarely both. Pond apple trees often show the same sort of buttresses when growing in soft mud (see upper photograph, page 688).

The clinging roots against the trunk of this cypress are those of a strangling fig (*Ficus aurea*), whose flat leathery leaves and dangling clusters of branches show against the feathery foliage and delicate flowers of the cypress. A flourishing colony of weeds has taken possession of the clearing. The edge of what is left of the original hammock appears in the distance. After no more than about two years' progress of civilization around Okeechobee, only such remnants of the unique pond apple hammocks and other plant associations are left

A CYPRESS TREE WITH NUMEROUS KNEES AND LITTLE BUTTRESSED

Fine branches seen among the cypress limbs are those of a strangling fig, which begins life in the form of a vine and depends upon the cypress for support. It is rare to find a cypress that does not harbor a strangling fig. This solitary cypress was photographed in a field recently cleared on the southern shore of Lake Okeechobee. In clearing land cypress is often left, perhaps only because so difficult to uproot

composition, luxuriant vegetation had sprung up on nearly every part of the banks. Prostrate herbs, among them *Bramia,* formed dense carpets; while morning-glory vines (*Convolvulus*) formed mats. Plumelike bonesets (*Eupatorium*) and a brilliant yellow coreopsis covered large areas. A score of other kinds of bright-colored flowers were in evidence nearly everywhere. A milkweed relative (*Philibertella*), a stout vine, with stems and branches seventy feet long or more, ran over the shores and banks in much the same way as the railroad vine (*Ipomœa Pes-Capri*) grows on the seabeaches.

At the mouth of the canal we spent several hours in lifting the "Barbee" over the bar, as we had done when we entered. After she glided into deep water, we sailed up to the vicinity of the mouth of Fisheating Creek and then headed eastward for a point on the opposite shore of the lake about midway between Chancy Bay and Pelican Lake, which course represented the widest part of Okeechobee. We were soon in ten feet of water and then made rapid progress to the eastern shore.

Owing to the low level of the water, there was a very wide sandy beach partly carpeted with grasses and sedges. The hammock begins about the top of the ridge with a fringe of cypress. Back of this is a dense growth of maple (*Acer*), holly (*Ilex*), ash (*Fraxinus*), and pond apple (*Annona*). The herbaceous plant cover is so complete that one rarely, if ever, sees the ground upon which he is walking. One of the more interesting herbaceous plants here is the climbing valerian (*Valeriana*), a delicate vine with clusters of small white or pink flowers. Liverworts, mosses, and ferns cover nearly all the ground about the trees and also a great part of the tree trunks themselves. Several kinds of tropical ferns occur in profusion, evidently owing to the protection afforded by the thirty-odd miles of water lying to the westward. Everywhere we had been, both in the Everglades and on the western shore of the lake, vegetation had been killed or severely damaged by the almost unprecedented "freeze" of the preceding February; but on the eastern shore and in the hammock swamps behind it, there was not the least sign of damage from the severe frosts, and vegetation was as fresh and luxuriant as it apparently had been for ages.

After sunset we weighed anchor and proceeded southward to hunt for the beacon that marked the entrance into the lake of the West Palm Beach Canal. Fortunately, this beacon was lighted and we had no difficulty in finding our way into the canal, where we tied up to the bank for the night. At sunrise we moved into the canal for a distance of a couple of hundred yards, where sand and humus were piled up higher than elsewhere, and went ashore to explore a magnificent hammock which clothed the ridge that gradually sloped off into the Everglades toward the east.

This hammock is picturesque beyond description. The trees for the most part are pond apple. The trunks are strongly buttressed, apparently thus developed so as better to maintain an upright posture on the soft mud floor. Herbaceous plants and vines are present in abundance. The most interesting vine is a species of dew flower (*Commelina*), which grows in mats and in dense masses, often with stems and branches more than half an inch thick, climbing into the trees to a height of from fifteen to twenty feet.

Here, too, the milkweed vine, instead of growing on the ground, climbed into the trees where it formed tangled masses of stems and leaves on the tree tops. We found evidence again, in the presence of several tropical species of epiphytic orchids on the pond apples, of the protection afforded by the waters of the lake against the cold westerly winds. The tomato grew wild in the hammock and was laden with myriads

of fruits no larger than a small cherry. Our cook gathered a supply from which he made us soup and stew, which we had for dinner as we started down the canal toward the eastern coast.

After we reached the Everglades several stops were made along the banks for collecting. The first was on the southern bank of the canal at the head of what was formerly Pelican Lake. Four years ago this lake was one of the most beautiful spots I had seen. When cruising in Okeechobee in 1913 we spent an afternoon and a bright moonlight night in Pelican Lake. Then it was filled with floating islands of the water hyacinth and water lettuce. It was surrounded by beautiful pond apple hammocks which were fringed with a growth of water hyacinth and water lettuce made up of plants more robust and larger than had previously been recorded. The hammock islands served as immense heron rookeries and the waters abounded in alligators of all sizes. Today it is a waste. The lowering of the waters of Okeechobee has changed these conditions and, instead of the paradise described, the exposed bottom of the lake as far as the eye could see supported a dense growth of the large pigweed "careless" (*Acnida*). The sight was disheartening.

Similar cases of unique areas that should have been preserved for future generations might be cited by the score. Many localities whose natural features are not duplicated elsewhere could easily have been made state or federal reservations, if the public officials had had the proper interest in such matters. In Florida, aside from Royal Palm State Park, there are no reservations for the preservation of the natural features, except those maintained by a few interested individuals, and a partly developed national forest. Steps for protection of selected areas should be taken at once by state or federal government. It is not yet too late to save much.

As we started down the canal a plague of horseflies overtook us. No matter how many we killed, their numbers seemed to increase. We passed through still another plague: the Everglades were covered with a moving mass of giant grasshoppers, known in some southern localities as "devil's horses." They are from three to five inches long, with stout yellow and black striped bodies. They are too clumsy to fly and their walk is decidedly awkward, and if birds did not dislike them for some reason, they would furnish a large food supply. The assemblage was moving northward. In many places the southern bank of the canal was a living mass, with myriads of grasshoppers in the rear pushing those ahead into the water where most of them were drowned. The few that reached the northern bank passed on into the Everglades.

Late afternoon found the "Barbee" approaching the pine lands back of West Palm Beach. At that point we came upon a large dredge that blocked the canal. Two boats that had preceded us were also held up. The dredge occupied the width of the canal and was in the act of digging a channel by its side to let the boats pass. While we were waiting for the completion of this channel, we were informed that the canal ahead was closed, that the county officials at West Palm Beach, wishing a road across, had filled in the canal and carried the county road over instead of building a bridge. In the face of such brilliant engineering work, there was nothing left for us to do but to turn around and retrace our course through the Everglades.

Although we had seen a part of the Everglades which would have been denied us had we known in advance that our course was blocked, we were exasperated at the loss of time, and decided not to stop until we reached Lake Okeechobee again. By continuous running we came to the end of the canal sometime between midnight and daybreak.

After a few hours' rest we set out to

hunt for the mouth of the canal to Fort Lauderdale. The channel between Kreamer and Torry islands was too shallow to be navigated and we were forced to run to the westward of both. Even out where formerly there had been deep water we found only enough to float the "Barbee," and all the way to the southern end of the lake we slid slowly along the smooth mud bottom, which was almost as level as a floor. At last a beacon hove in sight and we thought our troubles had come to an end, but as we neared it and turned into the indicated channel we ran up on a mound of putty-like mud. We decided that it was best for all members of the party to jump overboard and walk in different directions until some one should step into deep water. Thus, defying alligators and giant catfish, not to mention other strange animals that might have been prowling in the dark waters, we walked about that part of the lake until one member of the party reported deep water a quarter of a mile to the northward. We gradually maneuvered the boat into this deeper channel and finally found our way to the head of the canal leading to Fort Lauderdale.

As we entered the canal, truck growers begged us to carry their vegetables to Fort Lauderdale; but we could not assist them owing to the shallow water. After we passed through the first lock, in spite of our improvised water ballast, the keel of the "Barbee" repeatedly scratched the tops of submerged rocks. When we were within a few miles of the lower lock, although running at slow speed, the keel struck a rock a glancing blow. This turned the boat toward the side of the canal, where the propeller hit a rock with force sufficient to bend the shaft. The bend was not sharp enough to prevent the shaft from revolving, but each revolution was accompanied by an irritating thud. In this condition we crept along to the lock, where we tied up for the night, and in the morning made Fort Lauderdale by running the engine at the lowest speed possible as well as by taking advantage of the slight current of New River.

In order to save a day's time for further field work and to care promptly for the specimens we had collected, we telephoned to Buena Vista for an automobile. As soon as it arrived the party divided, and several members with the perishable specimens hurried to Miami, while others spent the day taking the boat down the coastwise canal.

From the scientific standpoint the cruise was successful beyond anticipation. The vegetation and structure of a part of our country which is nowhere duplicated were studied. Many geological data were discovered from the deposits of fossil marine shells, and a series of photographs obtained of scenery and of plant associations which in the near future will have ceased to exist.

The Grafting of Tissues

PRACTICAL VALUE IN REPAIRING THE WOUNDED OR DISEASED HUMAN BODY.—THEORETICAL VALUE, AND SOME OF THE FACTORS WHICH CONTROL SUCCESSFUL TISSUE TRANSPLANTATION

By LEO LOEB

Professor of Comparative Pathology, Washington University Medical School, Saint Louis

THE grafting of plant tissues is a well-known and practiced custom, one which has become so important that should the practice be discontinued, the present high grade of our fruit orchards, for instance, would completely disappear. Some remarkable results have been produced experimentally, such as the grafting of the nightshade on to the tomato. The great value, however, lies in the exactness with which cultural varieties can be propagated without the serious loss of type characters that inevitably follows from reproduction by seed. All of us are doubtless familiar with the results obtained by grafting a young twig of the double rose on to the root of the wild variety, obtaining thereby the beauty of the former and the hardiness of the latter.

In grafting animal tissues, transplantations succeed better among the lower animals than in higher classes, just as the regenerative power for injured or lost parts is on the whole greater in the lower forms. The more complex the organism, the more difficult it is to accomplish the transplantation successfully, the more must the various factors which control the phenomenon be carefully studied. Because of the very practical importance in replacing lost or injured tissues in man, much study and experimentation have been conducted by scientists in order to understand the process most thoroughly, and as a result of these studies much has been learned.

Grafting of tissues is a procedure used by the surgeon in cases in which there are defects somewhere in the body which are very extensive. Without grafting, such defects either would not heal at all or they would leave a scar which might threaten to interfere with the normal activity of the body. During the last four years, in dealing with the ravages of war on the human body, even the features of the face have been built up of grafted tissues in many instances. Defects in the skin are perhaps most frequently treated by grafting; but grafting of bone, tendon, fascia, and fat tissue is resorted to in certain cases.

It is therefore of great practical interest to analyze the factors on which successful grafting (transplantation) of tissues depends.

But of much greater importance is perhaps the theoretical interest that attaches to grafting of organs. The experimental method permits us to place a tissue under conditions which differ from those under which it lives normally. We can vary such conditions at will and thus we can obtain an insight into the factors which determine the life and growth of tissues in a normal as well as a pathological state. It is a mode of investigation which brings us in touch with the deepest problems of biology and pathology, namely, factors determining growth and life itself. Many diseases are caused by abnormalities in growth of various tissues. In diseases of the heart, liver, kidney, pancreas, thyroid, and other organs, abnormalities of tissue growth are often the underlying factor.

But there is in addition a disease which represents altogether an abnormality of tissue growth. This is cancer. Cancer is an abnormal, excessive, and continuous tissue growth or proliferation. In comparing the conditions which determine the growth of normal tissues with those of cancerous tissues, which latter we can graft in a way very similar to normal tissues, we obtain a deeper insight into the character of cancerous growth.

In the following we shall limit our discussion to a few of the factors which come into play if we graft a normal tissue from one animal to another or from one part of the body to another part of the same animal. The greater number of the experiments in grafting tissues are carried out in smaller animals, like guinea pigs, rats, mice, and rabbits.

In transplantation of animal tissue we are concerned in a general way with three conditions: (1) the character of the host, that is, the animal or tissue in which the graft is made; (2) the character of the graft, that is, the tissue to be transplanted; and (3) the relationship between the host and the graft. We know that a wounded tissue will heal much more rapidly and perfectly in a young than in an old person. There is something present in the young that is deficient or wanting in the old. Likewise a graft grows better in a young host than in an old one. This characteristic is particularly noticeable in experimentation on transplantable tumors in mice; it also applies, at least in certain cases, to the transplantation of tissues that are not abnormal. Experiments of this sort indicate that the young animals differ from the older ones in the character of the substances circulating in the body fluids. What then may these substances be? Are they the ordinary food constituents—the proteins, fats, carbohydrates, and mineral substances, or the two more elusive yet specific substances known as "vitamines"—both of which are necessary for maintenance as well as growth? Or are they special growth substances such as are known to exist in the *corpus luteum* of the ovary, in the thyroid, and probably in the pituitary gland?

Although these questions cannot be definitely answered at the present time, the results of many and varied experiments indicate that the advantage which the young animal possesses is not due to the quantity or quality of the food stuffs but more likely to some sort of specific growth substance. It has been shown[1] that substances circulating in the tadpole cause those remarkable metamorphic growth processes which occur in the life of the developing salamander. Tissue grafted on a tadpole from another tadpole undergoes metamorphosis at the same time as the host. Experiment has determined that the *corpus luteum* of the ovary gives off at certain times a substance which, circulating in the body of the host, will cause a placental structure to be produced. On the other hand, it has been found difficult to graft tissues in animals bearing young, but here there are indications that abnormal substances are circulating in the body fluid which exert an injurious influence on the transplant, or perhaps neutralize, in some way, the specific growth substances which are normally present.

The fate of the graft is dependent also upon the character of the grafted tissue itself. A good evidence of this fact is that growing embryonic tissue which is not yet fully differentiated is more susceptible to successful transplantation than adult tissue which is fully differentiated.

In each organ there are formed different constituents which vary greatly from one another in the ease with which they lend themselves to transplantation. On the whole, the simpler structures, the ones developing first on-

[1] Uhlenhuth, *Proc. Soc. Exper. Biol. and Medicine*, Vol. XIV, 88, 1917.

togenetically, and also those structures which have the greatest power to regenerate, best withstand the injuries resulting from the process of grafting. Thus, the excretory ducts are more resistant than the secreting portion of the glands, the small follicles of the ovary are more resistant than the large follicles, and the ordinary connective tissue cells are more resistant than the *corpus luteum*.

The transplantability of tissues, however, is greater than is usually assumed. The spleen tissue may live for a considerable period of time, if transplanted into near relatives. After transplantation of liver, carried out under favorable conditions, not only bile ducts and connective tissue may survive, but also the liver tissue proper. The liver cells even may multiply by mitosis under these conditions.

There exists a definite graded relation between the structure of a tissue and the amount of unfavorable conditions which such a tissue can tolerate without being destroyed. Such unfavorable conditions are always present after transplantation. Thus the excretory ducts can withstand a greater combination of unfavorable conditions than liver cells or the cells of the convoluted tubules of the kidney.

There are other more or less accidental factors which play a part in determining the result of transplantation. It is found that after transplantation of skin, the epidermis is destroyed in a number of cases even under otherwise favorable conditions, and this in spite of the simple structure of the epidermis which, as such, would readily lend itself to transplantation. The presence of hair (combined perhaps with the hardness of the keratin, its chief constituent which is constantly produced by growing epidermis) leads to its destruction. Almost invariably a piece of skin transplanted subcutaneously forms a cyst. Around the hair the transplanted epithelium is injured and the stimulus of the hair acting as a solid foreign body causes the connective tissue to grow. Along the hair this connective tissue pushes into the cavity of the cyst, gradually filling it and causing a destruction of the epidermis. Another accidental factor of importance occurs in grafting a lobe of the thyroid gland when it sometimes happens that fat adhering to the thyroid remains attached to the organ and is carried into the host together with the graft. The peripherally situated fat tissue prevents the thyroid from developing and consequently there is produced a deficiency in acini in the thyroid graft wherever fat tissue was adherent to the thyroid proper. Therefore great attention must be given to removing carefully all extraneous tissue in carrying out such transplantations.

Again, the fate of the graft is determined by the relationship between the transplant and host. Each individual belonging to a certain species differs from every other individual in the structure of certain proteins which are a part of all, or almost all, of the various kinds of cells as well as of the blood of each individual. Even children usually differ from their parents and from their brothers and sisters, in this respect. Greater than between relatives is the chemical difference between unrelated individuals; greater still is the chemical difference between different strains belonging to the same species. White mice, for instance, which have been bred in different countries and may be otherwise indistinguishable from one another, may show marked chemical differences, while between different species the chemical differences are greater still, and the differences increase the farther apart the species are in the genealogical system. Thus the fate of the graft depends upon the chemical relationship between graft and host. Generally it can be stated that the greater the chemical difference between graft and host,

the greater will be the injury to the transplanted tissue; this is especially so in the tissues of the higher animals; it is apparently less so in the phylogenetically lower organisms.

In mammals we find that, on the whole, grafts can live indefinitely only after transplantation into the individual in which the tissues originated (autotransplantation). Some exceptions occur, however, to this rule—as, for instance, in the case of certain tumors, which can live and grow in other individuals of the same species; and perhaps the same may hold good in the case of a few particularly resistant tissues. After transplantation into other individuals of the same species (homeotransplantation) tissues usually die after a period of transitory life the duration of which varies in different tissues and different individuals. Even in nearly related individuals, grafts have usually a mere temporary existence, although in most cases they live longer than in individuals of the same species which are not related. It may be that occasionally the transplanted tissue lives in a near relative as well as it does after autotransplantation, but such cases, if they occur at all, certainly represent only a small minority. After transplantation into different species, tissues live a very short time, and they die the sooner the farther distant the species of host and transplant are from each other. In invertebrates, however, grafts may, under certain conditions, live permanently even in a strange species.

We have reason to assume that the chemical differences existing between graft and host lead to disturbances in the metabolism, or proper taking care of the food, by the grafted tissues. After transplantation into different species (heterotransplantation) these metabolic disturbances are so marked that the grafted tissues die either directly or after a short duration of life. After transplantation into other individuals of the same species some tissues are injured by the body fluids of the host to such an extent that they also die as a result of this chemical injury. Others, however,—and this applies especially to certain glandular organs,—suffer only a relatively slight metabolic disturbance in the new environment, a disturbance which as such would be perfectly compatible with the life of the tissues. However, this metabolic change in the transplanted cells attracts the lymphocytes of the host, which now invade the graft and help to destroy it; and, in addition, the connective tissue cells of the host may produce more fibrous tissue around a homeotransplant than around an autotransplant and thus interfere with the nourishment of the graft.

These two factors bring about more or less gradually the death of the transplant in cases in which the body fluids alone would not be sufficiently toxic to produce this effect. In general, the more sensitive a tissue is, the more susceptible it is to the injurious effects of those toxic substances which are present in all homeotransplantations.

While only autotransplanted tissues can live indefinitely, the temporary life of tissues taken from other individuals of the same species, or preferably from nearly related individuals, may be of great practical importance, inasmuch as it may permit the adjoining host tissue to repair defects in a much more efficient manner than could be accomplished through grafting of dead material or tissues taken from different species. The investigator is constantly faced by new problems. Also he is rewarded by new knowledge which promises to throw light on fields which apparently are far removed from that of tissue growth. Thus tissue grafting may serve as a method which helps to clear up problems of immunity.

Charles Richard Van Hise (1857–1918)

HONORED FOR A LIFE DEVOTED TO SCIENCE AND PUBLIC WELFARE—TO RESEARCH, CONSERVATION, AND EDUCATION

By CHARLES P. BERKEY

Professor of Geology, Columbia University

PRESIDENT Charles Richard Van Hise, of the University of Wisconsin, whose death was recorded in November, was born at Fulton, Wisconsin, May 29, 1857. He was educated in the schools of Wisconsin, including the University, so that he was the product of a typical American public school system. He became the best known and most representative man of his state and one of the best known educators of America.

The University of Wisconsin gave him the degree of bachelor of mining engineering in 1879; bachelor of science, 1880; master of science, 1882; and doctor of philosophy, 1892. Honors of many kinds were showered upon him after he had made a world-wide reputation as a scientist and had come into prominence in the councils of education. The degree of doctor of laws was given by Chicago in 1903; Yale, 1904; Harvard, 1908; Williams, 1908; Dartmouth, 1909.

He began his career as a teacher in metallurgy, gradually changing to mineralogy and to geology, leaving that ultimately to devote himself wholly to executive and public service work. His first appointment to the teaching staff at the University of Wisconsin was in 1879 as instructor in metallurgy, in which position he continued until 1883, when he was made assistant professor and in 1886 professor of metallurgy. During part of this time, he was under the influence of the late Professor R. D. Irving, who was then preparing his great monograph on "The Copper-bearing Rocks of Lake Superior." This association with Irving and the attractiveness of the field that he represented finally led to an entire change in his life work and the field of his investigations. Under these influences he grew to such mastery that with Irving's death, in 1888, he was appointed to the chair of mineralogy to succeed Irving. His genius for structural geology and the attraction of the very complex field represented by the Pre-Cambrian rocks which had engaged Irving, led him out of mineralogy proper into this most obscure and at that time almost unknown field. The background that he had in chemical principles gained in his metallurgical experience and in mineralogy was, however, a firm foundation for the kind of work that he now set about and in which he made a signal success. In 1890 he became professor of archæan and applied geology. In 1892 he was put in charge of the geology department, in which position he continued until he became president of the University in 1903.

His fame as a teacher and investigator and his recognized leadership in the field of structural and metamorphic geology made his name honored in the annals of science, and his assistance was sought by other educational institutions and by organized surveys. He was, for example, nonresident professor of structural geology in the University of Chicago for a period of ten years, while caring for his own work at the University of Wisconsin. He had been connected with Irving on the Lake Superior division of the United States Geological Survey under Powell from 1883 on, and at Irving's death he succeeded to his position in that work also. In 1900, he was put in charge of Pre-Cambrian and metamorphic geology on the United States Survey, with the rank of geologist, which position he

held until 1909. He was also at the same time consulting geologist for the Wisconsin Survey.

With his elevation to the presidency of the University in 1903, the energy with which he had developed his chosen science largely transformed itself into activities of a broader scope, connected with the executive work of his own institution, the welfare of the state, and with commissions on many matters of national importance. From 1908 to 1915 he was a member of the Wisconsin State Conservation Commission; 1909, a member of the National Conservation Commission; 1912, chairman of the Board of Arbitration between the Eastern Railroads and the Brotherhood of Locomotive Engineers; in 1915, chairman of the commission appointed by the National Academy of Sciences at the request of President Wilson to report on the Panama Canal slides; in 1909, he was made one of the trustees of the Carnegie Foundation for the Advancement of Teaching.

He was a member of many societies and influential organizations. Among those representing his scientific relations are the Wisconsin Academy of Science, Arts, and Letters, of which he was president from 1893 to 1896; the Geological Society of America, of which he was president in 1907; the American Philosophical Society; and the National Academy of Sciences, to which he was elected in 1902.

He was the author of many scientific and general articles. His most enduring contributions were in the field of geology connected with his elaborate and vigorous investigations of the principles represented in the complicated and very ancient formations of the Lake Superior region. The most important works of this type are: "Principles of North American Pre-Cambrian Geology," 1896; "The Iron-ore Deposits of the Lake Superior Region," 1901; "A Treatise on Metamorphism," 1904; and "The Geology of the Lake Superior Region," 1911 (with C. K. Leith), all issued through the United States Geological Survey. There are many other titles, but more are unnecessary. It is worth noting, however, that some of these titles represent very elaborate pieces of work instead of simple articles; for example, "A Treatise on Metamorphism," listed above, represents a great *Monograph*, Volume 47, of the United States Geological Survey, which is a quarto volume of 1286 pages.

President Van Hise has exercised a peculiarly pervading influence on geology, largely by reason of his genius for constructive investigations in a field of very varied relations and his ability to bring an obscure and baffling lot of data into an organized system. The principles that he emphasized or reworded and the applications of them that he made and suggested have modified the whole product of geological workers in those particular fields ever since his work became known. But his contribution to his chosen science and his influence upon his associates is almost equaled by his success in the broader field of administration and general public service. It has fallen to few of the scientists of our day to see his own work so widely used and so generally appreciated as is the work of Van Hise. His death came in the midst of his activities and before any of his remarkable powers were dimmed.

He was a man of positive conviction and vigorous expression, but, with it all, he kept so rigidly to the true scientific attitude in his zeal for truth that he roused few antagonisms and made practically no lasting enemies. His own native state—more than that—all America, and the whole world for that matter, wherever contributions to science and to conservation and to education are appreciated, may well honor the name of Van Hise, who throughout an active life has been a great contributor both to knowledge and to public welfare.

A World of Billions

By W. W. KEEN, M.D.

Emeritus Professor of Surgery, Jefferson Medical College, Philadelphia;
Major Medical Corps, United States Army

"With the passing years, I am more and more impressed with the wonderful 'mechanism' of Nature, which to me bespeaks—God." [Quoted from letter to the Editor.]

OCCASIONALLY it is a great relief to turn away for a season from a review of the Great War with all its horrors, atrocities, and sorrows, and think about some wholly detached subject. Our passions are stilled, our emotions subdued, and our minds are freshened for a time.

"Does the title suggest the Liberty Loans?" you ask. No, not that. "Then the number of bushels of various grains in our harvests?" No, not that. "Then it must be the number of dollars spent every year or month or day by the various belligerents?" No, not even that. You will hardly guess it. It came to my mind in this wise.

Not long since, one morning as I was shaving, it suddenly occurred to me that there were only two means by which we could actually *measure* the growth of any part of the human body from day to day—the finger nails and the hair. During the Civil War, S. Weir Mitchell, George R. Morehouse, and I often compared the rate of growth, especially of the finger nails, for example, in cases of gunshot wounds of the great nerves of an arm, or of paralysis of one half of the body. We stained one or more corresponding nails on both hands with nitric acid or nitrate of silver. The new growth of the nails would be free from stain and would show the relative rate of growth on the two hands at a glance. But the growth of the nails is too slow to be a satisfactory index of daily growth. On the contrary, the hair, and especially the beard, grow so rapidly that in twenty-four hours the stubby outgrowth of each hair is long enough to be easily seen. It gives one an untidy appearance. "Unshaven" is equivalent to neglect of the proprieties, one might almost say, of the decencies of life. As I thought of it while my razor was rasping away the hair, I reflected that it introduced me into "a world of billions."

But this immediately brought to my mind another instance of multiplied billions, not the billions of cells in solid substances like the hairs, but the billions of cells in that life-giving fluid—the blood.

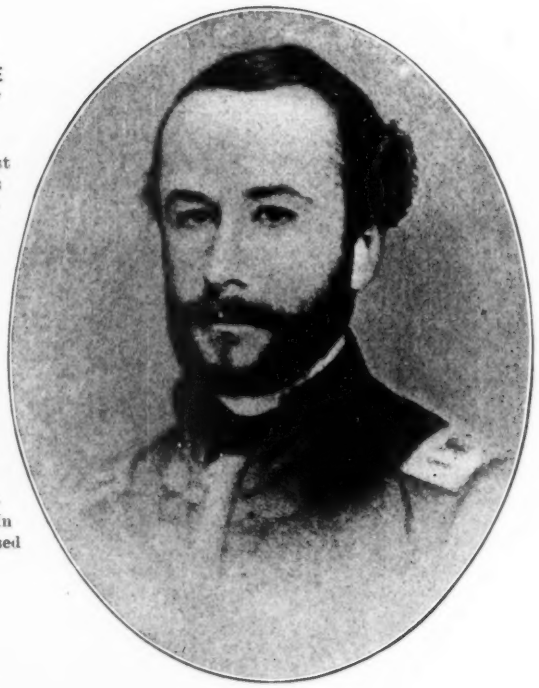
As is well known, the blood consists of a liquid in which float the red blood cells or blood "corpuscles." These are round, disklike cells about $\frac{1}{3000}$ of an inch in diameter. Besides these red cells there are other cells called the "white cells" or "leucocytes." These number several thousand in a cubic millimeter, but though of great importance, physiologically and pathologically, we may disregard them in our census of the blood cells.

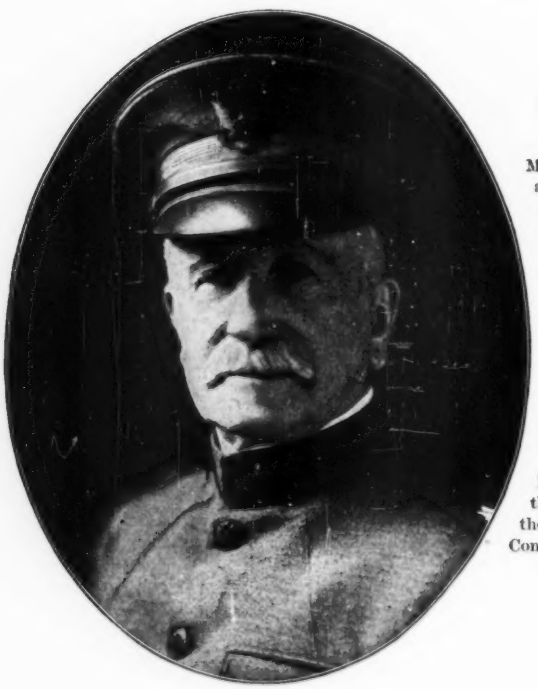
My friend, Prof. John C. Da Costa, Jr., of the Jefferson Medical College, at my request has furnished me with the following estimates:

The total amount of blood in a man weighing 144 lbs. and in good health is about 12 pints. The number of red blood cells in each cube of blood measuring only one millimeter ($\frac{1}{25}$ of an inch) on each side is about 5,000,000. Sometimes this rises to 6,000,000, 7,000,000, or even 8,000,000 in a cubic millimeter. The number of red blood cells in one pint is, therefore, on the lowest basis, approximately 10,240,000,000,000, that is, ten thousand, two hundred and forty billions.

A VOLUNTEER IN THE UNITED STATES ARMY 1861

Major Keen received his first commission in the United States Army on July 1, 1861. In 1862–1864, he served in the Ascension and Eighth Street general hospitals at Washington, D.C., the Satterlee Hospital, and with Drs. Weir Mitchell and G. R. Morehouse in the Hospital for Nervous Diseases and Injuries at Turner's Lane, Philadelphia. When the United States Medical Reserve Corps was established in 1909, he immediately volunteered for service and was commissioned First Lieutenant. In April, 1917, his rank was raised to that of Major





MAJOR W. W. KEEN 1917

Major Keen, of Philadelphia, is a man of international reputation and a pioneer in many branches of surgery. The foremost brain surgeon of America, he was one of the earliest to operate upon brain tumors. He has been connected for many years with the Jefferson Medical College of Philadelphia, as lecturer and professor of surgery, and is a member of many of the leading scientific societies of this country and Europe. (This portrait and the above reproduced through the courtesy of Houghton Mifflin Company)

I

Remarkable Activity in the World of Billions

The number of these red blood cells destroyed and renewed every day in the ordinary activities of life cannot be accurately estimated. But we can get an approximate idea.

No physical or mental process can be accomplished without the destruction and regeneration of millions, or more likely of billions, of these blood cells in bringing oxygen from the lungs to burn up waste tissue and to aid in building up new cells and new tissues.

You lift an arm, you eat a meal, you reason about anything—every one of these actions means the using up of the cells in the muscles of the arm, or of the muscular cells of the walls of the stomach, and the cells of the glands producing gastric juice, or of the cells of the brain. The blood is one of the agents in effecting these various processes, and billions upon billions of its cells are used up every day.

The loss of blood in accidents, wounds, and operations must be made up quickly in order to keep us in good health. In an accident or in any serious operation the loss of blood may easily amount to a half tumblerful, a tumblerful, or even more. A tumbler holds six ounces. A loss of half a pint, eight ounces, is not very uncommon. In a serious accident, such as a shell wound in France, attended with great hemorrhage, the loss might amount to as much as three pints—about one fourth of the estimated total amount in the body. Bierfreund estimates that such a loss may be made good in four weeks. In three pints of blood there would be about 30,720,000,000,000, that is, thirty thousand, seven hundred and twenty billions of blood cells. In every hour of the four weeks then there would be a regeneration of more than 45,000,000,000 of cells, or more than 760,000,000 cells every minute, day and night, for four weeks!

Not only are the blood cells destroyed and regenerated at this enormous rate, but all the tissue cells which make up the muscles, the bones, the brain and nerves, the liver, pancreas, spleen, kidneys, are being destroyed and regenerated day by day.

Confessedly these figures are only approximate, but even if they are, the impression of the *enormous* cellular activity of the entire body is justified. Is it not a wonder that the body does not get tired of doing such hard and never ceasing work?

But to return to the beard and the growth of each hair, which introduced us to the world of billions. The amount of daily growth of the beard may vary possibly from man to man, with health and illness, with the seasons, with the quantity and quality of the food, possibly from race to race, or with different latitudes from the poles to the equator. Even different parts of the beard grow at different rates—toward the margin of the beard near the eyes the growth is less rapid than on the cheeks and the upper lip.

The number of hairs in the beard it is impossible to count, but let us assume that it would probably be say 5000 on an average face. Then we must remember that the beard is only a small portion of the hair on the human body. Besides the hair on the face there are the hairs on the head, in the eye-brows and eye-lashes, and finally the fine lanugo or soft hairs which overspread the entire body, growing to groups of long hairs in the armpits and other parts of the body, but disappearing entirely on the palms of the hands and the soles of the feet. With age, we men at least, usually lose the hair on the top of the head which becomes bald over a smaller or larger area. On the ears the hair often increases markedly in length after middle life. Even in women a mustache not uncommonly

develops sometimes to an almost disfiguring degree. I have seen in some male patients the ordinarily fine hairs over the body, arms, and legs develop into a hairy coat over nearly the whole body, quite comparable with that of the lower animals.

My problem was: How much does each hair of the beard grow every twenty-four hours; how many new cells are thus produced in each hair; and finally, what is approximately the total number of new cells produced in the beard each day?

Recently I collected the fragments of hair which I had shaved from my face and asked Professor Aller G. Ellis, of the Jefferson Medical College, to measure them and if possible give me an estimate of the number of cells per hair which must have grown on my face in twenty-four hours. He found that each hair had grown about one millimeter ($\frac{1}{25}$ of an inch) in the twenty-four hours, and that the number of cells in that length of one hair would be about 10,835. This would indicate a growth of more than 450 cells every hour, day in and day out. This, remember, is for the new growth of only *one* of the hairs shaved off. If now we accept 5000 as the number of hairs on the face alone, that would mean 14,175,000 new cells had grown every twenty-four hours, or nearly 600,000 cells every hour, or 10,000 cells every minute in the beard alone. Cut the figures in half if you wish. The fact is just as marvelous.

If we broaden the calculation to the hair all over the body, growing on the head at probably a somewhat slower rate and still more slowly all over the rest of the body, we would have a world of billions upon billions of hair cells, as of blood cells, produced every day.

The same enormous activity is seen in the destruction and restoration of the cells in many glands such as those that secrete the saliva which flows so abundantly when we chew our food; in the glands of the stomach, for its share in the digestive processes; in the glands lining the entire twenty-five feet of the intestine, producing the intestinal juice (*succus entericus*) so important in digestion. To these are to be added the enormous activity of the accessory organs of digestion, such as the liver, which secretes about twenty-five ounces (about $1\frac{1}{2}$ pints) of bile every day, and the pancreas, which pours out a large quantity of pancreatic juice to aid in digestion. To these must again be added the activity of the kidneys and of the millions of sweat glands. These two—the kidneys and the sweat glands—curiously enough are much alike. The skin might be called a kidney unrolled and spread out over the surface of the body, and conversely, the kidneys two portions of rolled-up skin placed within the abdomen.

In emergencies the skin may actually perform the function of the kidney. When I was a medical student—in the long, long ago, now verging upon sixty years!—I had in my own person a striking example of this "vicarious" action of the skin when my kidneys "struck work." I was very ill with a violent tonsillitis and a high fever—how high I do not know, for it was before the days of the clinical thermometer (!), but I should judge that it must have been 104° to 105° F. Lying in bed, I perceived a most disagreeable urinary odor. I first thought it was due to the neglect of the maid. But this proved not to be the case. I soon observed whenever I brought my hands near to my face as in taking a drink of water or using my pocket handkerchief that a whiff of this disagreeable odor was pronounced. Then I deliberately investigated the condition of my skin and found that it was doing nearly all the work of the kidneys—a most dangerous condition, which might easily be followed by uremic coma and speedy death. Prof. J. M. Da Costa, who was attending me, at once took the most

vigorous means to stimulate the kidneys. These remedies, with hot drinks, a sharp purgative, and abundant drinking of water soon averted the danger. In the case of some patients the urea excreted by the skin has actually formed crystals on its surface.

How many billions, trillions, and quadrillions of cells in the blood, the hair, the innumerable glands of the intestines, in the liver, the pancreas, the kidneys, the brain, and the skin perish and are replaced every day no one can possibly estimate. That such huge armies of cells serve us every day, every hour, every minute of our lives day and night, in sickness and in health, and as a rule in orderly sequence so that the balance of health is maintained, or in case of illness is restored, gives one an idea of the wonderful mechanism of the human body—nay, of the whole animal and even of the vegetable kingdom, for only by the same nice adjustment of number and function of cells to the needs of the body of the man or the animal or the plant can health be maintained.

Moreover, the great strength of these minute cells is wonderful. We are all familiar with the bricks or even the heavy flagstones around the trunks of trees on our sidewalks which are lifted and tilted by these same little cells growing slowly but inexorably. I well remember seeing in the old churchyard at Jamestown, Virginia, a full-grown sycamore tree which had split a great bowlder in two. The little tree had found a chink into which it had insinuated its slender stem. Then these myriad Lilliputian cells, slowly but steadily increasing in number, had gradually thickened the tree trunk and finally had rent the stone asunder.

II

The Organization of the World of Billions

Every plant and every animal, including man himself, starts from one microscopic cell which multiplies indefinitely until the number mounts to millions and billions. The rapidity of this growth in some instances is almost inconceivable. The cholera bacillus multiplies from one to two; these two divide into four; these four into eight, sixteen, and so on *every twenty minutes*. In seven hours, provided it has room enough and food aplenty, *one* single cholera bacillus would have more than 2,000,000 descendants, and three hours later more than 1,000,000,000, and so on. These 1,000,000,000 in twenty minutes would become 2,000,000,000; in twenty minutes more 4,000,000,000. In twelve hours after the first single cell with which we started had begun to multiply, its descendants would number about 64,000,000,000,000, sixty-four thousand billions of cells. What *would* the number be in a week or a month!

Or again, consider the silkworm. In thirty days after being hatched from the egg it increases in weight 15,000 times; that is 500 times its original weight every day. We can get a more impressive idea of what this means by comparing it with a human baby. Were the same rule to hold, a baby weighing seven pounds at birth would weigh 3500 pounds the very next day, and when a month old would weigh 105,000, or more than fifty short tons, which, however, could hardly be called "short weight." If you will pardon the abominable but expressive argot of the street, that would be "some baby." But we may be somewhat consoled by remembering that both mother and nurse would be of corresponding elephantine bulk—made to "fit the job" as the exponents of efficiency would say.

But this is a gross, unimaginative way of looking at such a phenomenon. When we analyze it seriously, what a wonder world we enter upon! How these little silkworms must feed, feed, feed! Think of the abounding life of each microscopic cell. Every one has

to multiply itself five hundred times in every twenty-four hours. Yet all goes on in an orderly manner, according to the law of its being, but with incredible swiftness, day after day.

In the development of a human or an animal body the increase is far more, however, than a mere numerical increase, although that in itself is a wonderful phenomenon. Among these multitudinous cells a wholly new factor soon comes into view. They do not all continue merely as multiplied duplicates of their predecessors but they begin to differentiate among themselves. Some will become first cartilage, that is, gristle cells, and later, when the blood carries to these cartilage cells lime and phosphorus and other mineral ingredients, these cells bathed in the liquid portion of the blood will pick out each its own required mineral compounds and will turn from soft, flexible cartilage to stiff, yet elastic bones—the skeleton of the animal.

Other cells will remain soft but will select those ingredients which are necessary to form the muscles—that is, the red flesh of animals or the white and dark meat of birds. These muscles acting on the bones as levers will move them so that we can lift the ribs and by the diaphragm depress the floor of the chest and thus aid further in expanding the lungs for inspiration; then we reverse the action, depress the ribs, compress the abdominal viscera, and so push up the diaphragm, thus compressing the lungs for expiration. Thus the alternate processes of breathing—a continuous function essential to life—are carried on. We are also enabled to regulate our breathing and our vocal cords in such a manner that we can speak or laugh, swallow or sing.

Still other muscles attached to our jaws permit us to eat, others to our legs allow us to move about, others to our arms and fingers fit them for labor or other useful functions.

But these muscles do not move of themselves. They require a stimulus connected with the center for our mental organization. Thus then the need for a nervous system—in fact, as I shall show, for two interdependent and correlated nervous systems. The first of these two systems is composed of the brain, the spinal cord, the nerves emerging from the latter, and the special end-organs in which the nerves terminate. From the skin by means of these special organs at the ends of the nerve fibers, impulses start and are carried to the brain. In the brain they are appreciated, for instance that the finger is in contact with a source of too great heat. The brain quickly decides that the finger must be withdrawn, and sends down to the proper muscles the order to retract at once. In such a case, long before the whole of this brief description has been read, the muscles have executed the order. This is but one example of a voluntary movement resulting from a sensation.

The second nervous system consists of the sympathetic system. At certain important points collections of nerve cells are gathered into small bodies called ganglia. These ganglia are connected with one another by a large number of nerves. The familiar "solar plexus" just in front of the spine at the level of the "pit of the stomach" is the largest and most notable collection of such ganglia.

The nerves of the sympathetic system are distributed to the muscular cells in the walls of every artery in the body. This muscular coat consists chiefly of circular fibers, which, by their contraction and relaxation change the caliber of the arteries and thus regulate the supply of blood to all parts of the body according to its needs.

For example, the eye is a very familiar instance. When a cinder gets into the eye, in a short time the white of the eye becomes very red or "bloodshot," but returns to its normal whiteness as soon as the foreign body is re-

moved. The sudden redness of a young girl's "blushing" cheeks is caused in the same way.

Again, when we have eaten a meal, the stomach needs a very large and sudden increase in its supply of blood to elaborate the large quantity of gastric juice required for digestion. Instead of a rather dirty looking brownish yellow appearance, as when it is empty, the stomach (like the eye) at once becomes of a bright red color from the dilated blood vessels. As soon as the meal has been digested, the nerves stimulate the circular muscles of the arteries. By their contraction these immediately lessen the caliber of the blood vessels, and less and less blood reaches the stomach until at length the supply is only enough for the ordinary demands of the stomach in its period of inactivity, and it has reverted to its original brownish yellow color.

These sympathetic nerves are distributed not only to the muscular coat of the blood vessels but to many other muscular fibers which are involuntary, that is, not controlled by the will. We have an excellent illustration of this in the iris, the circular colored disk in the eye with a hole in the center which we call the pupil. This is constructed like a wheel with a circular hub and radiating spokes. The "hub" consists of circular muscles which, by contracting, narrow the pupil to a pin point. The spokes are radiating muscular fibers which pull the pupil wide open. We go out into blinding blazing sunlight. For a moment we wink and blink, or have to shade the eyes by the hand or by closing the eyelids. But in a few seconds the muscular fibers of the hub contract strongly, the pupil narrows down to a pin point, and the eye is automatically protected from the injury which it would otherwise suffer. On the contrary, we go into a darkened room. At first we may stumble over the furniture which we cannot see on account of the small amount of light entering the eye through the minute pupil. In a few minutes the pupil has been dilated by the "spokes," or radiating fibers, to a maximum, and we can see everything with perfect clearness.

All these changes, be it observed, are perfectly involuntary. They are accomplished for us, and in fact, in spite of ourselves. We do not order the blood vessels to dilate when a meal is eaten, or order them to contract when it is digested. We do not order the pupil to contract or dilate according to the brightness or the dimness of the light. In fact we cannot by any possibility control the caliber of the blood vessels of the stomach, or the size of the pupil. It is all done for us whether we wish it or not. And it is most fortunate that this is so. Suppose it had to depend on our conscious volition. Suppose, tired out and hungry, we ate a hearty meal and fell asleep! The stomach would get no increase of blood, there would be little or no gastric juice secreted, no digestion would take place. What endless confusion there would be! Before long we should surely perish! In the case of the pupil, the bright light might easily seriously damage the eye, or we could never see in a dimly lighted room.

In this rather long discussion we have almost forgotten that we were considering the differentiation of the rapidly multiplying cells into bone cells, muscle cells, and cells forming the brain, spinal cord, and nerves to control the voluntary muscles, and the sympathetic nerves to control the involuntary muscles.

If we examine a chicken embryo, we shall find even as early as the third day the well-recognized and differentiated parts of the organs of sight, of hearing, and of smell. When we remember the ultimate excessive complexity of these organs, especially of the eye and the ear in man, this faculty of differentiation causes our wonder and astonishment to

become intense. By it cells that at first could not be distinguished from one another eventually develop into cornea, iris and pupil, lens, and retina—the retina alone having ten different layers!—and the strong and tough outer protecting fibrous envelope of the eye; the three bony semicircular canals of the internal ear lined with their soft membrane, the wonderful spiral cochlea in which are distributed the nerve filaments forming the ultimate organ of hearing; the three little bones of the ear attached to one another and by flexible membranes to the internal ear, and externally also to the drum of the ear.

And as if all this were not enough, there are certain other cells which become segregated—shall we say segregate themselves?—from the others and develop on an entirely different plan from any of the others. Some of them form a long hollow tube, the esophagus, followed by a dilated part, the stomach, and then the intestines. The stomach has a wholly different function from all the rest of this long tube, which is about twenty-five feet long in man and far longer in some of the lower animals. The stomach portion of the tube suddenly narrows again at the pylorus, the outlet from the stomach into the small intestine, and finally widens anew into the large intestine. Throughout its length this digestive tube is lined with different sorts of glands to aid the different stages of digestion. Connected with this long digestive tube are two large accessory solid organs—the liver to secrete bile, the pancreas (the "sweetbread" in animals) to furnish a juice to aid digestion.

At the same time other cells are segregated at one point to form the spleen. Its function is still, in part, as yet obscure. Its presence is not essential to life for many times it has been removed, and the patients get along without it, as they do also without any gall bladder or appendix.

Still other cells are segregated into two masses of cells which form the two kidneys. The character and function of these cells become wholly changed. Their secretion is wholly different from that of the glands in connection with the mouth (for saliva), in the stomach (for gastric juice), in the liver (for bile), in the pancreas (for pancreatic juice), in the intestine (for the intestinal juice) all aiding in digestion, that is, in the nourishment of the body. The cells of the kidney select from the blood such of the waste products as otherwise would accumulate in the blood and quickly threaten life. Hence their enormous importance. As a surgeon I would far rather operate on a patient with very grave heart disease than on one whose kidneys were seriously out of order.

The sweat glands of the skin as I have already pointed out are analogous to the kidneys, and supplement, or may even replace them.

All the stages of development of all these different tissues have been diligently worked out, chiefly in the fertilized egg of the hen. One can abstract an egg from an incubator at any definite time, one hour, two, three, four hours, or on the second, third, fourth, fifth day and so on, carefully open the egg shell, harden the embryo chick in certain fluids and then cut it into very thin slices which are kept in their serial order. These "serial sections" are so thin that the light easily passes through them. This enables us to study each one in detail. They can be cut also lengthwise, crosswise, or obliquely. By these means the embryologist can examine each section, each system, each organ, or even a part of any organ. By suitable stains one can differentiate and study the individual cells of the various tissues.

Occasionally accident will furnish a human embryo in which similar examinations by similar methods may be made. These absolutely establish the

fact that the development, as studied in the chick and other lower animals and in the human ovum and embryo, follows exactly similar lines. Similar organs develop in similar ways. The whole vertebrate kingdom from the lowest animal consisting of only one cell to man, follows the same general plan although varying in details from animal to animal, and growing more and more complex as we ascend in the scale.

III

The Wonderful Powers Implicit, *i.e.* Infolded in the Fertilized Ovum

Having reviewed the enormous number of cells in the blood and the body—whether of man or other animals—and their orderly development by differentiation in structure and function, it will be of interest to consider the wonderful powers implicit—that is to say, which are infolded—in an ovum. These powers remain latent until fertilization takes place. Then they immediately start up into amazing activity. We can best study it in the development of the chick in the fertilized hen's egg as just indicated. From the moment when the hen begins to sit, hour by hour, there begins and goes on during the whole period of incubation (twenty to twenty-one days) the most marvelous growth and development. Within even the first three days there is developed, in the growth from the one single cell, a mass in which can already be distinguished the front, middle, and hind parts of the brain, the starting points of the eyes and the ears, even the pulsating heart can be seen, divided at first into only two separate halves. There is a beginning of the circulation of the blood. What will become the lungs, the liver, and the pancreas are recognizable. Later the fore and hind limbs of quadrupeds, the wings and legs of birds, or the arms and legs of the human body begin as little buds. The cartilages of the digits (fingers and toes in man) soon follow. Foster and Balfour[1] say that on the fifth day "the embryo of a bird does not materially differ in its early phases from that of a reptile or a mammal, even in the points of structure which are most distinctively avian" (that is, characteristic of birds). By the sixth day the distinction becomes clear.

In all this apparent "hurly-burly," as when a cell in the silkworm multiplies itself 500 times each day, or less swiftly in the cases of vertebrates, there is an orderly, almost uniform development of each animal after its kind.

For a moment let us limit ourselves to the consideration of the human body and ovum. Look at the symmetrical and asymmetrical organs of the body. We have two ears, two eyes placed always in front and not at the side of the head as in the fly, the horse, and many other animals, always at a certain distance apart, within a very slight maximum and minimum range; two ears, two arms, two legs, two lungs, two kidneys. Even the nose is symmetrical; but the two nostrils are fused into one central organ. The tongue also is composed of two symmetrical halves fused together. The bones of the head are as a rule in pairs, right and left, or if in the middle line, they have originated in two symmetrical halves as in the upper jaws (maxillæ) which are not fused together, while in the lower jaw (the mandible) the two halves are permanently united for its special function of biting and crushing the food. The ribs, right and left, correspond to one another. The complete or ideal vertebra consists of a body and a pair of ribs which are also joined together in front, not directly but indirectly, by means of the sternum or breast-bone. In the neck the ribs are suppressed, but have their representatives in little processes or knobs of bone. In the loins (the lumbar

[1] *Elements of Embryology*, p. 275.

region) there are also no ribs, but their representative vestiges are even more marked than in the neck.

Asymmetry rules chiefly in the internal organs. Most of the heart lies to the left of the mid-line of the body. As already stated it begins as two separate halves, which soon fuse into one heart with four cavities, two auricles and two ventricles. Each of these four chambers has a different function but all four are coördinated into one beautifully regulated organ. The heart is one of the most wonderful pieces of mechanism in the world, more powerful in proportion to its weight than any Baldwin locomotive, more delicately constructed than the finest watch; an organ, which must do, and—*mirabile dictu!*—does do its own repairs while busy at its work. It knows no Fourth of July or Christmas or Easter holiday, never even can know the joy and relief of sleep, "tired nature's sweet restorer." It begins its orderly, reiterated contractions and relaxations long before birth, and they cease only at death. It must continue them in health and in sickness, when its function is often sadly disturbed. In mid-career let it stop for but a few moments and death comes swiftly, almost instantly.

Sometimes, oddly enough, by a very early irregular development, asymmetrical organs are transposed, and then, as in *"Le Malade imaginaire," "nous avons changé tout cela"* is literally true. This is very rare, so much so that in a long and active professional life, I personally have never seen a case. When it occurs, the heart, stomach, and spleen lie on the right side, the liver and appendix on the left, and the large bowel reverses its course, running upward on the left side.

In this enormously complex machine, far more complex than any of man's making, a machine, all parts of which, like the heart, must be repaired without the omission of an hour's or even a moment's work, it is not surprising that things sometimes go awry. The wonder is rather that they almost always develop aright. Nature is persistently conservative. To this conservatism we owe it that most people are practically normal. Especially fortunate is this conservatism during the early development of the embryo. Then, every cell is working feverishly and at top speed, and a minute divergence of, it may be, even a single cell, followed by a progressively greater and greater divergence from the normal in its descendants, would produce an arrest of development here, or an error of development there; but only occasionally is there such a failure of orderly or of complete development. The result is a local, or even, it may be, a general failure in normal growth. If there is one deformity, therefore, there are very apt to be others.

The saddest of all of these errors of development are those cases in which there has been a defective development of the brain and hence a mentally defective child. How many scores, or I might even say hundreds, of such children have been brought to me with the fond delusion that, "He is naturally an unusually bright child, you know, but with a pressure on the brain." How often have I had to dash unfounded hopes to the ground! The children have been brought to me in the confident expectation that I could cure them by a surgical operation that "would remove the pressure on the brain." An explanation that the defective development was by no possibility to be laid at the door of either the father or the mother, but that the defect was prenatal, and had long preceded birth has often afforded the distressed parents some little comfort, although it can never wholly remove the heartache. The only hope for such children is in educating the more or less blighted faculties; a long continued, expensive business, and often with but a slight improvement as a reward for years of

parental devotion. In other cases, such as cleft palate, harelip, and clubfoot, surgery holds out relief by operation.

Let us now go back again to the single cell of the fertilized ovum in which the human or animal body always begins. We have seen its development into many billions of cells which have become differentiated from one another and have formed many different tissues (bone, muscle, or nerve), and many different organs (brain, eye, ear, liver, or kidney), in which the ultimate cells differ enormously from one another, although all have had this common origin in the single cell of the fertilized ovum.

Think for a moment of the enormous powers latent in that single little microscopic, primordial cell! Nothing that I know of can for a moment compare with it. If we know its origin we can foretell its development into a horse, a bird, a fish, or a human being. We can foretell that it will show the racial traits of its parents to a greater or less degree: the white skin, the black skin, the yellow skin; the straight hair or the curly hair; the oblique or the horizontal eye; the racial nose of the Roman, the Greek, the Hebrew, or the Negro; the high cheek-bone of the American Indian. There are marked physical resemblances in many, if not in most cases, even to the features of the parents and the brothers and sisters which in turn may be transmitted to the next generation. Nay, more, in that tiny cell are contained the forces that make not only for the physical structure and the intellectual characters of his race, but also for those of his nation, and it may be, of his particular family. In it are contained *in posse,* and if fertilized and developed, *in esse,* the powers of a Newton, a Shakespeare, a Franklin, or an Abraham Lincoln.

Why should the little bud which is to become a human arm always develop at exactly the right place and not grow out on the front of the chest or on the back nearer the spine? Why should the human arm grow to its proper length and then stop, instead of growing far longer as it does in our simian ancestors? Why should the two arms (and the two legs) always grow to virtually the same length? Why should the human body grow for about twenty years and then stop growing?

The answer is evident. In that single, primordial cell there existed a force, a law of orderly development which compelled all these phenomena to take place, and to take place at the proper situation and in the proper sequence; and, when the proper time came, the laws enshrined in that primordial cell said to the lengthening arm and the heightening frame, "Stop," and they stopped!

As a rule each tiny egg develops in an orderly normal way the characteristics of its particular breed of ancestors. The sheep's ovum will develop into a timid adult, while that of the lion will be courageous and cruel; in the different breeds of horses one ovum will develop into a powerful draft horse, another into a fleet race horse; if it be a dog's ovum it will develop, it may be, into the swift greyhound, the fierce bulldog, or the fawning spaniel. If this be true of horses, dogs, and cattle, should it not be true of men? I firmly believe in the virtues, and alas, as the Great War has revealed them, in the vices, inherent in different breeds of men and of nations. Good blood is a great asset whether in horse or man.

I confess I stand in awe before such manifestations of power packed, one might say, into such a microscopic space. To me there is no other explanation of such a mighty gift save from an Almighty Giver—the Fountain of Life, the ever blessed God. I bow before Him in reverence and also in gratitude that we live in a world of such wonderful Order, instead of a world of blind Chance.

Characteristic coast scene of Bermuda.—The Bermuda Islands are of limestone formed through the centuries by coral polyps; the islands rest on the top of a suboceanic volcano. This discovery was made in deep well boring

"The Flora of Bermuda": A Review[1]

By JOHN W. HARSHBERGER

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THE Bermuda Islands have long attracted the American tourist because of their accessibility to New York City by a regular line of fast steamers. The number of visitors has been reduced greatly since the present war began, but there is every reason to believe that the popularity of these islands will be restored when the final treaty of peace is signed. There are so many attractions that it is hard to know where to begin in enumerating them. The blue sky and still bluer sea, rivaling the Bay of Naples in depth of color, the coral reefs, the bathing, the boating, the sailing, and the deep-sea fishing have long been famous. The geologist has been attracted by the interesting matters connected with the formation from the ground-up remains of corals and calcareous seaweeds of the rocks, the sands, the soil, and the limestone caverns with their stalactites. The character of the sinks and picturesque cliffs has also appealed to him. The recent discovery, described by Dr. Britton in the introduction of his book, that the limestone cap lies on top of rocks of volcanic origin, as revealed by deep well boring, is a matter of intense interest. The visiting geologist is informed that of the 1400 feet penetrated by the boring, the first 360 feet are in the limestones of the usual character known in Bermuda. Below them for 200 feet, soft yellowish to brown, often clay-like rocks are met, whose nature indicates that they are more or less decomposed volcanic tuffs. Below them blackish to gray compact volcanic rocks are found, of andesitic and basaltic appearance. The study of the section made from a chip indicates that this is a lava, and, though considerably altered, an augite-andesite. This rock continues without essential change in character for the remaining 800 feet penetrated. The zoölogist is fascinated by the beautifully colored fishes, by the sea anemones, the holothurians, the

[1] *The Flora of Bermuda*, by Nathaniel Lord Britton, pp. xi, 585, New York, Charles Scribner's Sons, 1918.

coral polyps, the Amphioxus, and the phosphorescent insects and sea animals, which light their ghostly lamps as the short tropic twilight begins to blot out the distinctness of the landscape.

The botanist and the lover of plant life, to whom this volume will appeal most strongly, are interested in the scenery of Bermuda at once, as the steamer, after a voyage of two days and two nights from New York across the Gulf Stream, approaches the archipelago. The hill slopes are clothed with the deep verdure of the prevailing Bermuda cedar broken here and there by cultivated fields and clumps of the native palmetto. The blue sea penetrates the land here and there, and the promontories are characterized by the location of attractive villas and planted grounds. The white roofs of the cottages are seen above the tops of the ubiquitous red cedars. The student of plants finds that he can travel readily to all parts of the island group by the fine roads, which are kept in excellent repair by the liberal use of the crushed limestone rock.

By the use of the manual which Dr. Britton and several collaborators have given us, he can soon learn the more important native plants, which species have been introduced and escaped from cultivation, and which are grown in the fine gardens of the native Bermudians. The eleven species of indigenous flowering plants soon become old acquaintances; some of them are common, as the blue-eyed grass (*Sisyrinchium Bermudiana*), which appears in color as the frontispiece of the manual and the color of whose flower is attractively reproduced on the covers. The four endemic ferns, including the maidenhair (*Adiantum bellum*), as well as the mosses, lichens, and algæ, have no doubt been collected by him, if in search of a representative collection of the native plants. He soon learns by a study of the *Flora of Bermuda* that about 80 per cent of the native land plants inhabit the West Indies, or southern Florida, or both. About 8.7 per cent of the total native flora is endemic, there being 61 species in Bermuda or its waters not known to grow naturally anywhere else in the world. The number of introduced and completely or partly naturalized species is about 303. The number of species of cultivated plants which either grow now in Bermuda or are recorded as having grown there, is 864. The number of native species known, those that have reached Bermuda independently of human activities, including the flowering plants, ferns and fern allies, mosses and hepatics, lichens, algæ, and fungi, is at least 709.

Many of these forms are illustrated, so that with a description of them, and a fine bibliography and glossary, the visitor should not be at a loss to learn a great deal about the vegetation without undue expenditure of effort. The labor which the author has expended in the field, in the herbarium, and in the library, will render easier the labor of others, who may undertake to investigate other phases of the plant life of the archipelago. A more detailed study of the fungi and the diatoms is a desideratum, which, unless investigated by some person resident in Bermuda, must sooner or later be undertaken by some visiting mycologist or diatomist.

The species of the Bermuda flora are arranged under their respective families, and the handy keys under each family group, with the line drawings given in the text, will enable the tourist lover of plants to identify the greater number of those of the islands which will be met in excursions from place to place, from St. George at one end to Ireland Island at the other. The more interesting facts about the plants have been incorporated. The reader of the book will find, for example, interesting facts about various trees.

The endemic palmetto (*Sabal Blackburnianum*), for instance, is common in all but saline situations, and the plants differ greatly in size, depending on soil and situation. This palm, which shows hourglass constrictions of its stem, was first named botanically by Glazebrook in 1829 in the London *Gardener's Magazine*, 5:54 and there illustrated. The specific name was given in honor of a Mr. Blackburn, in whose collection in England it was then known, but all record of its origin had been lost, other than that it came into possession of his grandfather in 1737. It is now frequent in greenhouses in Europe and occasional in West Indian gardens. Its closest relative is probably *Sabal Palmetto* of Florida, the Bahamas, and Cuba, from the seeds of which, brought to Bermuda by floating, it may have sprung through isolation. Baskets of many kinds, hats, dish-mats, napkin-rings, fans and other small articles are made from the bleached leaves. An intoxicating beverage

called "Bibey" was formerly distilled from its fruit.

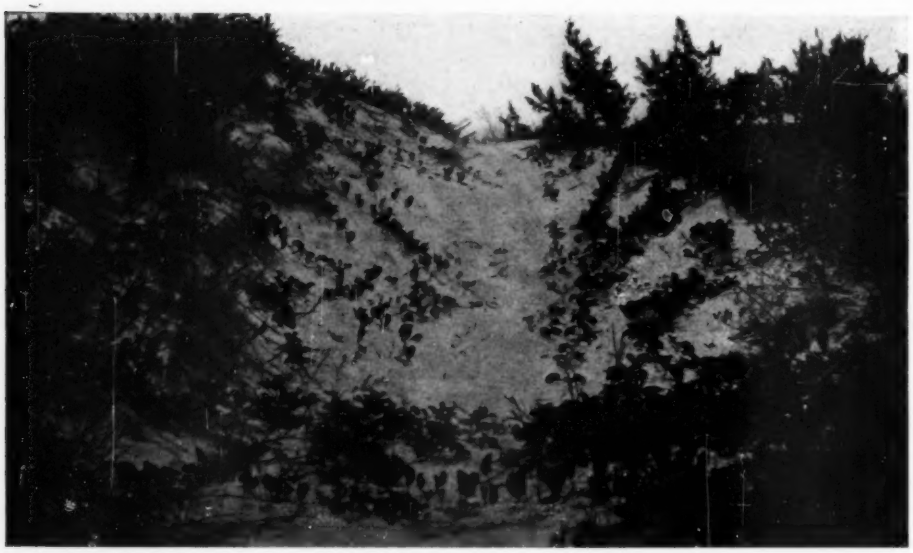
The yellowwood, or satinwood (*Zanthoxylum flavum*), native of Florida and the West Indies, was widely distributed in Bermuda many years ago, but nearly exterminated by cutting for its valuable lumber, which was exported to England. This business was restricted by gubernatorial proclamation as early as 1632. Old records prove the occurrence of large trees in Cooper and Ireland islands prior to 1693. The large tree recorded by Governor Lefroy as 30½ inches in girth about 1872, was, in December, 1912, 33⅕ inches (83 cm.) in girth. It bears Lefroy's initials (RHL). This tree flowered and fruited abundantly in September, 1913.

The olive appears to have been introduced prior to 1612, being one of the first Old World trees brought to Bermuda. In 1661 the Bermuda Company ordered it widely planted, but it never became the basis of an industry. Lefroy states that some of the trees planted in 1661 were standing about 1875. This may very well apply to the ancient tree still in perfect condition at Norwood, and perhaps to one at Walsingham. The fruit produced in Bermuda is small and of inferior quality, averaging only about half an inch in length.

Critical studies, which Dr. Britton has made of all the plants described by him, will enable botanists to make the first careful comparison of the Bermuda plants with those of regions near by in order to determine the evolutionary processes involved in their differentiation as new forms. A question might be asked in this connection: Is the "age and area" hypothesis of Willis verified in an intensive study of Bermudian plants, such as has been presented in this volume on the flora?

The visitor from the Eastern United States will find such familiar plants as the narrow-leaved cat-tail, eelgrass, Spanish bayonet, weeping willow, bayberry, red mulberry, pigweed, four-o'clock, chickweed, life plant, red and white clovers, garden nasturtium, flax, poison ivy, Virginia creeper, tamarisk, sea lavender, persimmon, oleander, French mulberry, henbit, heal-all, spearmint, peppermint, Jamestown weed, mullein, rib grass, chicory, shrubby fleabane, seaside goldenrod, and many others. These and a number of the common weeds of Europe, which are cosmopolitan in their distribution, will give him a floral nucleus on which to begin a more detailed examination of the Bermudian vegetation.

Dr. Britton's book will be indispensable to all those persons, whether native Bermudians or otherwise, who wish to become acquainted with an interesting, near at hand, oceanic, insular flora.



The pink flowers of the bay bean (*Canavali lineata*) give color to the sand dunes and sea beaches through nine months of the year. The original seeds probably floated to Bermuda from the West Indies or Florida

"Personal Identification" [1]

By L. R. SULLIVAN

MOST systems of identification are connected in our minds with criminals and are dismissed as being unimportant for honest men and women. The attitude of the public generally to the practice of finger printing was well illustrated by the reaction of the alien enemies, especially the women, whose finger prints and photographs were recorded at the time of registration. Some felt that they were eternally disgraced, and others, with relief, believed they had very narrowly escaped the electric chair itself.

Such a conception is very unfortunate. The criminal side is but a small part of the whole problem. To one case involving a criminal, there are a dozen in which the individual to be identified has committed no wrong.

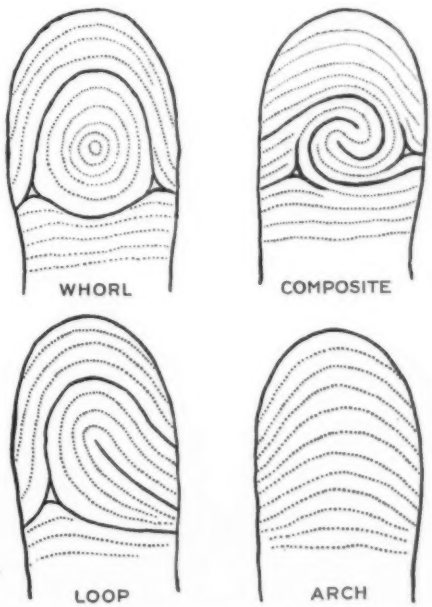
Personal Identification, by Professor Wilder and Mr. Wentworth, besides serving as a very complete handbook of the technique of the various systems of identification, aims to correct some of the fallacies in the minds of people and to prove the usefulness and even the necessity, to every individual, of a method which will furnish absolute identification.

The various systems so far adopted are discussed in turn and their merits weighed. It is pointed out that there are times when the name and the aspect of the face and figure are not sufficient for identification. There may be a duplication of features and expression. Photographs often fail to establish identity because features and expression may change in the course of time. Marks, scars, and tattoo, while valuable within certain limits, are cumbersome to record and classify.

How far anthropology has progressed is shown by the fact that even if only a skull or other part of the skeleton is found it is possible to give in some detail a description of the sex, size, and race to which the individual it represents belongs.

The Bertillon system of accurate measurements of the body and head, supplemented by descriptions of the hair and of eye color, is very valuable, and in the greater number of cases establishes identity. Several instances are noted, however, in which two individuals presented very nearly the same measurements and proportions throughout.

But for a final and conclusive means of



Courtesy of Richard G. Badger

All the designs formed by the ridges on the ends of the fingers can be classified under some one of these four general types. If it is desired to describe a design further than merely calling it a loop or a whorl, it can be done with reference to the "delta" or triangle, shown in the cut by the conjunction of the heavy black lines. The arch has no delta, while the whorl and composite both have two. In the case of the loop, for instance, a count is made of the number of ridges found between the delta and the central ridge of the loop or the "core" (which in this case is three). Consideration is also given to the direction in which the open end of the loop points, whether toward the little finger or toward the thumb side of the hand, known respectively as the ulnar and the radial sides. Then, assuming that the loop in the drawing is from the right hand, it is described as a radial loop with a count of three

[1] *Personal Identification. Methods for the Identification of Individuals, Living or Dead.* By Harris H. Wilder, Ph.D., Professor of Zoölogy, Smith College, and Bert Wentworth, Former Police Commissioner, Dover, N. H. Published by Richard G. Badger, Boston, Mass. 1918. 374 pages, 150 figures.

AN ILLUSTRATION OF THE PERMANENCE OF THE FINGER PRINT

Courtesy of Richard G. Badger

These six prints are from the right thumb of a little girl and were taken at intervals of about two years from the ages of four to fourteen. They illustrate the absolute permanence of the design throughout ten years of rapid growth. For practical purposes in demonstrating the identity of, or difference between, two prints, use is made of the "Galton details," that is, "forks" formed by the branching of a ridge, "ends," "islands" which are very short ridges with only one sweat pore, and "enclosures" where a ridge branches and promptly unites again. If, in comparing a fragmentary chance impression (such as might be left by a person handling an object) with a known print, twelve points of identity can be made out, it is considered sufficient proof that both impressions were made by the same person

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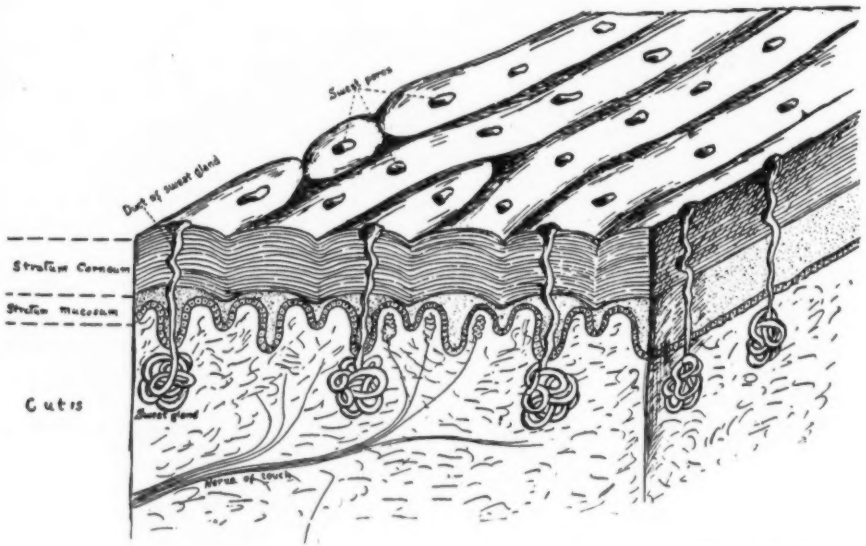

Courtesy of Richard G. Badger

FRICTION SKIN OF THE HAND AND FOOT

Diagram showing microscopic structure of the skin of the palms and soles, known as "friction skin." It is composed of two layers, an upper horny layer and a lower mucous layer, both of which are folded into ridges with reference to rows of sweat glands. On the left of the diagram can be seen a short oval ridge with a central sweat pore opening. It is by the fusion of such elementary structures that the ridges are formed. In mammals of orders lower than the apes these ridges are so arranged that they prevent slipping, after the manner of antiskid ridges on automobile tires.

Where identification of persons by means of the designs formed by the friction ridges (see illustration, page 721) is not possible because of the incomplete or fragmentary character of the print, it may sometimes be effected through microscopical comparison of the sweat pores. The impressions of the pores on two similar prints supposed to have been taken from the same person can be compared with reference to their size, form, number to the area, and position on the ridge.

The now famous system of finger printing was put on a scientific basis by Sir Francis Galton who received the first inspiration from Sir William Herschel. Galton's writings on the subject include *Finger Prints* (1892), *Decipherment of Blurred Finger Prints* (1893), and *Finger Print Directories* (1895). Herschel had used the prints in India as a semisuperstitious method of having the natives sign documents, a use which was even known in ceremonials of the ancient Chinese. After Galton had worked out a scientific scheme it was put into actual use by Sir E. R. Henry, of New Scotland Yard, London, at the beginning of the present century

Courtesy of Richard G. Badger

Photographs from Scotland Yard of three men who so closely resemble one another that they might easily be mistaken for the same person. Their thumb prints, however, show such marked differences that no one would have trouble in identifying these at once as having been made by different individuals. One advantage in the use of finger prints for identification in criminal work is owing to the fact that the friction ridges are formed of sweat pores whose oily secretions keep the fingers sticky, so that whenever a man handles an object his fingers leave an impression, especially as he is likely to require a sufficient use of his sense of touch to preclude his wearing gloves. Sometimes faint imprints are developed by applying powder with a camel's hair brush, black or white according as the impression has been made on a white or dark surface. The powder is then blown off. There is always danger of damaging the impression, however, and efforts are being made to discover some method of staining it with chemical fumes. The certainty of the identification has recommended this method not only to the police for criminal investigation, but also in some instances to banks and to the Government for the army and navy. The authors of *Personal Identification* advocate that a national registration of finger prints be made with the birth or school registration of the entire population

identification the authors find that the use of the configuration of the friction skin (best known in the form of finger printing) alone fulfills all the necessary requirements. If the reader will glance at the palmar surface of the distal joint of the fingers, he will observe that the ridges which make up the skin texture form very definite patterns. In general these patterns may be distinguished as loops, whorls, arches, or composites. In detail there is no limit to the range of variation in these patterns. The loop opening toward the inner side of the hand (ulnar loop) is the most common pattern. It occurs on the right middle finger in 74 per cent of cases. Yet it is overwhelmingly improbable that this pattern, as found on the finger of any one individual, exists in all its details on any other finger at the present time, or has ever been duplicated in history.

The points in favor of this system of identification may be summed up as follows: it is individual and impossible to duplicate in another individual; it is permanent; it is marked in four important and convenient places (hands and feet); it is easy to record and classify; and objects which a man has touched often retain a legible record from which his identity can be established. This system has been in use in criminal courts since 1895, and not a single judicial error can be imputed to it.

Finally much stress is laid on the value of a national identification bureau in which the palm and sole prints of every individual would be recorded. Such records would be invaluable in establishing the identity of individuals having a lapse of memory, lost children, in granting passports, travelers' cards, travelers' checks, identifying pensioners and beneficiaries of various sorts. It would also be valuable in maternity hospitals in identifying babies. In banks it could supplement signatures and prevent forgeries. In the case of illiterates it would eliminate the "mark." Chinese coolies and other undesirable citizens could in this way be detected. The system is already in use by our Government in identifying soldiers and sailors. Famous paintings and other works of art could be so marked that they could not be counterfeited.

The whole subject, which in parts is fairly technical and complicated, is made very clear and decidedly interesting by the numerous incidents taken from the authors' experiences or from records of widely known police courts and police commissioners.

Report on the Work at Aztec

THE season's excavating at the ruined pueblo located at Aztec, New Mexico (continuing last summer's work described in the November JOURNAL by Mr. Earl H. Morris, in charge of the work), began June 16 and continued with but two days' interruption until October 17. Heavy storms twice stopped the work but otherwise the weather was conducive to the very best endeavor. Owing to lack of spring rains and practically no fruit crop, the farmers of the valley would have been obliged to look elsewhere for work had there been no excavating this season, so that an abundance of labor was available and of a quality unusual because of the intelligent personal interest taken by the men. The problem of clearing the rooms successively and restoring the walls as the digging progresses is one requiring the best of planning and execution. The large floor beams firmly imbedded in the walls, when broken by the weight of falling floors and walls from above, have been torn out and the walls twisted and shaken, so that the mason in charge must exercise considerable care that no harm comes to the workers and that the restoration is made as speedily as possible. It required three masons and two helpers each to keep up with the work. The number of men employed easily averaged twenty-five a day and most of the time three teams were kept busy hauling away the rock and earth.

About fifty rooms and three kivas were dug out (emptied) and the diameter of one other kiva determined which is the largest in the pueblo and more than forty-six feet across on the floor level. The last week's work brought to light rooms on the court facing south which were plastered in bands half white and half red, and in one room under the outer layers of white plaster were found incised figures in the harder gray plaster. They resemble the well-known pictographs of the cliff and caves. A satisfactory colored Lumière process picture was made of this wall.

Of the burials uncovered the most interesting is that of an infant on its papoose carrier. Pack rats had removed many of the bones. Over a layer of corn husks, cobs, and other refuse was placed a worn reed mat and upon it another perfect one, the cradle and child being then deposited on the mat near one side. With this were found in perfect condition a small basket, a tiny boot moccasin, the buckskin covering for the head piece, fringed and decorated with horizontal bands of colored porcupine quills, and a bird bone necklace strung on white buckskin. A ceremonial stick and parts of a wooden baby cradle were not far away.

The work at Aztec has progressed so far as to warrant some definite historical conclusions. Pueblo occupation of the vicinity, either continuous or intermittent, lasted through a number of centuries. The great community house came as the culminating architectural achievement of a long period of growth and development, and itself went into partial ruin at least once and perhaps twice, with subsequent repair and reoccupation. The first builders completed the intended size and form of the fortress village and dwelt in it for generations, if one may judge from the bulk of refuse which accumulated during their occupancy, and from the fact that, during this interval, silt and sand raised the country level along the north side three feet above the foundations of the walls. Then, either because of neglect or entire abandonment, many quarters of the structure partly collapsed, filling the lower rooms with débris.

Later, as a result, perhaps, of an increase in resident population, but more probably as a consequence of the migration of clans, the partly fallen walls were repaired, new floor levels were laid, and additions were made to the structure on the court side; that is, the dwelling was made to accommodate a greater number of people than had occupied it at any previous time.

Again, after a lapse of many years, the population dwindled to a mere handful. It seems evident that the few remaining families were conquered by a hostile band or tribe, which went from room to room of the community house, intentionally setting fire to the ceilings. The ensuing conflagration so damaged the stronghold that it was not again reoccupied.—CLARK WISSLER.

Notes

SINCE the last issue of the JOURNAL, the following persons have been elected members of the American Museum:

Life Members, MESSRS. C. M. GARRISON, MURRY GUGGENHEIM, N. B. HERSLOFF, EDWARD K. LINCOLN, W. A. MARSHALL, CHARLES V. MILLER, HENRY A. MURRAY, JR., and FREDERICK STURGES, JR.

Sustaining Members, MESSRS. WM. R. BEGG, W. A. GRAMER, HARRY L. MARSH, and E. L. MAYER.

Annual Members, MESDAMES WINTHROP W. ALDRICH, MAURICE GOLDSMITH, HUGO S. JOSEPH, HENRY LAMBELET, ARTHUR W. LAWRENCE, SETH LOW, HENRY MORGENTHAU, JAMES E. NEWCOMB, ADOLPH OBRIG, WILLIAM M. POLK, ANNIE D. RAWSON, CHARLES F. SCHMIDT, MISSES EMILY L. CORNELL, EMMA B. HOPKINS, MARTHA K. HUMPHREY, FLORENCE L. POND, H. TOWNLEY, DOCTORS NELSON H. HENRY, AUSTIN W. HOLLIS, RICHARD JORDAN, MOZART MONAE-LESSER, EUGENE C. MOWRY, MEFFORD RUNYON, MESSRS. C. EDWARD BILLQUIST, GEORGE P. CONGER, JACOB DASHEW, WATERS S. DAVIS, WM. L. FISH, LORENZO M. GILLET, W. V. GRIFFIN, PERCY L. GUITERMAN, HENRY B. HALL, CHAS. C. HARRIS, GEO. A. HARRIS, RICHARD HARRIS, JULIUS HEILNER, C. H. HOOLE, F. T. HOWARD, GEORGE LELAND HUNTER, J. A. JEANCON, THOS. W. JOHNSON, DEWITT CLINTON JONES, ARTHUR J. KAHN, OSWALD J. KARSCH, FRED KAUFMAN, AUGUSTUS W. KELLEY, WILLIAM M. KERN, WILHELM KOCH, GUSTAV LANGE, JR., JOHN LANGTON, J. W. LEE, JR., HENRY LEON, J. C. LESLIE, LOUIS LEVI, C. SETON LINDSAY, CHARLES S. LIPPINCOTT, HOWARD J. LYONS, JAMES MCCOURT, JAMES R. R. MCEWEN, WM. H. MCGEE, EDWARD A. MACMANUS, J. G. C. MANTLE, WILLIAM MARBURG, ISAAC F. MARCOSSON, LANGDON PARKER MARVIN, HERBERT MEAD, JR., FELIX MEYER, GEORGE D. MILNE, WILLIAM G. MOLLER, C. D. MONTAGUE, A. CRESSY MORRISON, PHILIP J. MOSENTHAL, MOSS FERRIS MOSES, FLOYD W. MUNDY, HENRY B. NEWHALL, JR., EDWARD PLAUT, WM. C. POPPER, MAX RICHTER, JOHN E. ROUSMANIERE, R. SCHUSTER, FRED. W. SHIBLEY, SOL. D. SILBERSTEIN, W. N. STEVENS, E. M. TOWNSEND, and EDWARD P. TYSEN.

Associate Members, MRS. D. S. STANLEY, MISS S. K. PIERCE, THE HON. FRANKLIN FERRISS, DOCTORS THOMAS M. BULL, THOMAS B. FUTCHER, THE REV. JAMES BANCROFT, THE REV. WM. M. CHAPIN, MESSRS. ALBERT BABCOCK, LOUIS H. BARKER, R. DALE BENSON, JR., WILLIAM BINNEY, LOUIS H. BRÉGY, W. B. BROOKS, PERCIVAL CHRYSTIE, WALTER J. COMSTOCK, FRANK BATTLE DANCY, SR., WILLIAM C. DART, FOSTER B. DAVIS, WILLIAM ELY, CHAS. G. FITZGERALD, M. GILLET GILL, RUFUS K. GOODENOW, ERIK H. GREEN, WM. E. GUY, R. BROOKE HOPKINS, B. C. HOWARD, ROBERT H. KEISER, I. H. LIONBERGER, W. N. MATTHEWS, PAUL H. MILLER, M. IB NYEBOE, ALONZO PRICE, C. W. SCUDDER, JOSEPH NICHOLAS SHRIVER, DAVID S. H. SMITH, J. EDWARD STUDLEY, RUSH STURGES, KNOX TAYLOR, and ASHBEL T. WALL.

THE American Museum is a beneficiary under the will of the late Mrs. Russell Sage. The amount of this bequest is not as yet definitely known.

ON December 18 a gathering of members and friends of the American Museum in connection with the Red Cross Christmas Roll Call, presided over by Prof. Henry Fairfield Osborn, was addressed by Miss Kathleen Burke of the Scottish Women's Hospital, and Dr. Woods Hutchinson, of New York City. Colonel Burke, for she was recently made colonel of the 138th Field Artillery, in the United States Army, pictured scenes of the suffering in Belgium and France. She brought home to her audience the state of mind of the Allies in Europe, a state of mind that is still unknown to this country in its remoteness from German barbarities and the terrors of war.

Dr. Woods Hutchinson spoke of the work of the medical profession in the war. On account of his position as a sanitarian, the military authorities of the allied armies furnished him with facilities for viewing the medical work of the army in all its phases. The marvelous efficiency of modern surgery is demonstrated by the fact that 92 per cent of all wounded have been saved, while 80 per cent have been returned to the firing line. So skillfully has the surgeon accomplished his task that not more than 4 per

cent of the wounded will be crippled. These figures, Dr. Hutchinson pointed out, were the basis of the Germans' conclusion that inasmuch as a doctor, by returning about a thousand men to the front every few weeks, was worth to the Allies a battalion of infantry, the Medical Corps and the Red Cross were a fair target for artillery and aëroplane. At least two thirds of the hospitals Dr. Hutchinson visited had been bombed. He spoke of the work of reconstruction and reëducation in France, a work which has been so marvelously accomplished that three fourths of the crippled soldiers who have been taught new trades are earning more than they did before the war.

THE American Museum will perpetuate the memory of Sergeant Charles Connolly who lost his life in the heavy fighting in France in July, by planting a grove of fruit trees on the Ourcq near Château-Thierry.

THE American Museum of Natural History through the department of public education has prepared eighteen lectures for use by the Young Men's Christian Association in encampments at home and abroad. These consist of stereopticon slides and manuscripts prepared by various explorers. The Museum has mainly borne the expense of the preparation of these lectures. The cost, however, has been materially reduced by the volunteer help of the young women of the department of public education, who have contributed their services in coloring, binding, and captioning the slides of the lecture sets, and also in arranging and captioning about four thousand slides that were presented to the Young Men's Christian Association for war work.

A HOSPITALITY room, or "canteen," for men in uniform has been established by the American Museum of Natural History on the first floor of the building near the main entrance.

THE American Museum War Relief Association has "adopted" two war orphans for the period of one year, through the Belgian Relief Commission for Babies and the Fund for the Fatherless Children of France.

CHRISTOPHER SCHROTH, of the registrar's office in the American Museum, greatly distinguished himself in the fighting of the last few months of the war, receiving eight citations. He has recently been awarded the Croix de Guerre for exceptional bravery in action.

THE annual meeting of the New York Academy of Sciences was held at the American Museum of Natural History on the evening of December 16. The annual address by Professor S. A. Mitchell, of the University of Virginia, was delivered in the auditorium under the auspices of the American Museum, the New York Academy of Sciences, the American Scenic and Historic Preservation Society, and the Institute of Arts and Sciences of Columbia University. Professor Mitchell spoke on the general subject of eclipses. He drew particular attention to the great uncertainty of observation, mentioning instances in which parties had been dispatched half around the world at great expenditure of time and money, only to fail in obtaining any results on account of weather conditions. A feature of the observations made at Baker, Oregon, was the attention paid to portraying the corona. Through the interest of Mr. Edward Dean Adams, the services of the accomplished artist, Mr. Howard Russell Butler, N.A., had been obtained, and a painting was made that portrays the corona better than has ever been done before. The finished painting was exhibited in Memorial Hall of the Museum, together with the sketches on which it was based.

THE American Museum will continue its Second Asiatic Zoölogical Expedition for another year. The first expedition sailed from the United States in March, 1916, and the second in June, 1918, both under the leadership of Mr. Roy C. Andrews, of the department of mammalogy. So far Mr. Andrews has canvassed especially the Chino-Tibetan border and western tropical China as far as Burma. He is at present in Peking and proposes, as soon as the spring weather arrives, to proceed to Urga in northern Mongolia. This town is situated near the junction of two life zones, the Siberian and the Mongolian and Central Asian, and will accordingly make an ideal base camp. In this region Mr. Andrews expects to take moose, elk, wild boar, and other large game. After a four months' stay in northern Mongolia,

he hopes to hunt big-horn sheep along the Chino-Mongolian frontier. The species of mountain sheep found here is large, with horns measuring sixty inches. In following out the present program the expedition plans to be back in New York some time in February, 1920.

THE Royal Society of London, at its anniversary meeting on November 30, reëlected as president Sir J. J. Thomson, of Trinity College, Cambridge, and professor of physics at the Royal Institution, London.

THE British Museum is considering reopening exhibits which have been closed during the war, and placing again in their cases those objects which were of such value as to necessitate their storage in the basement for safe keeping from damage by Zeppelins. One wing of the building is still occupied by government offices.

PROFESSOR HENRY FAIRFIELD OSBORN, president of the American Museum of Natural History, has been awarded the Darwin Medal by the Royal Society of London. The following is quoted from *Science*, December 27: "The Darwin Medal is awarded to Dr. Henry Fairfield Osborn. Dr. Osborn's chief work has been in palæontology, and, in connection with it, he has organized many collecting expeditions to the early Tertiary rocks of the west. One of the results of his work is the more precise determination of the relative ages of the extinct mammals in North America, and that has led to a correlation between the order of succession of the Mammalia in Europe and in America. A good deal of this work was summarized in his book *The Age of Mammals in Europe, Asia and North America*, published in 1910. In 1900 Osborn had come to the conclusion that the common ancestors of Proboscidia, Eirenia and Hyracoidea would be found in Africa; and the correctness of this view has since been confirmed by Dr. [C. W.] Andrews' discoveries in the Egyptian Fayum. Amongst the more important of Osborn's contributions to our knowledge of extinct vertebrata are his memoirs on the rhinoceroses, the horses, the titanotheres and the dinosaurs. In addition to all the work he has done personally, Dr. Osborn has had a wide and most beneficial influence upon biological research in North America, and he has produced a flourishing school of younger vertebrate palæontologists."

ON exhibition in the Morgan gem hall of the American Museum is one of the world's finest known examples of gem carving, in the form of a chalcedony figurine eight inches high, "Pas de Danse," by the eminent French artist and stone engraver, M. Tonnelier. This graceful figure is carved out of an unusually perfect block of translucent blue sapphirine, of natural color (not stained), found in Uruguay, South America. It was a gift from the late J. Pierpont Morgan to his lifelong friend, Charles Lanier, who has generously deposited it in the Museum. The artist, M. Tonnelier, is a cripple, having the use of one leg only, and does all his work while seated on the corner of a high stool. He selects his material with the greatest care from the best that can be had anywhere, and never entrusts any part of his task to an assistant, or a pupil, not even the reduction of the rough block to approximate shape. The chalcedony figurine was exhibited in the Paris Salon in 1912.

THE Brooklyn Museum has put on exhibition a collection of enlarged photographs of the cathedrals and churches of devastated northern France. The collection of cathedral photographs, from which this group was selected, constitutes one of the most notable works in architectural photography that have ever been attempted. Mr. Wm. H. Goodyear, the Brooklyn Museum's curator of fine arts, has been interested for many years in the architectural refinements, or deviations from rectilinear and strictly perpendicular construction, found in medieval structures. Where reconstruction of the damaged churches of France is to take place these views will be of material assistance, while in the case of those buildings irreparably destroyed, the pictures form a unique and valuable possession.

ON the occasion of the twenty-fifth anniversary of the appointment of Dr. Frederick J. V. Skiff as director of the Field Museum of Natural History, Chicago, eighty-six of his colleagues presented him with an engrossed copy of resolutions congratulating

him on the successful career which the Museum has enjoyed during his directorship.

THERE has come to hand a noteworthy volume on *Decorative Textiles*[1] by George Leland Hunter. As an example of good taste in book-making, it leaves little to be desired. Over its 458 pages are spread many wonderful plates of color and numerous remarkable half tones. The author takes up the leading modern textiles used in home decoration such as damasks, brocades, velvets, laces, embroideries, carpets, rugs, tapestries, wall papers, and tooled leathers. Under each will be found a brief statement of the historic evolution resulting in the present forms, a characterization of the techniques by which the textiles may be recognized, followed by a lengthy illustrated account of distinctive type textiles. Special attention is given to prehistoric and primitive textiles and their place in the history of the textile art as a whole. The material for these sections is taken from the American Museum's collection. The publisher is the J. B. Lippincott Company (Philadelphia and London) and the printing was done on the press of the *Good Furniture Magazine*, our one high-class household art publication.

IN a recent book[2] from the press of the J. B. Lippincott Company is told the interesting story of the Virgin Islands from the time of their discovery by Columbus in 1493 to the present time. The volume is of particular interest to us since the United States acquired (on March 31, 1917, at a price paid to Denmark of $25,000,000) the important islands of St. Thomas, St. John, and St. Croix, together with a number of adjacent rocky islets, formerly constituting the Danish West Indies. The acquisition of these islands increases the territory of the United States by 138 square miles. Mr. de Booy spent the winter of 1916–1917 in the Virgin Islands engaged in archæological investigations in the interest of the Museum of the American Indian, Heye Foundation, New York City. This expedition and others to various parts of the West Indies which he has conducted in the interest of the same institution have brought him in intimate contact with the people and their home life. As the book owes its origin to the exploration of caves and the excavation of kitchen-middens of the West India Islands, we naturally find in it much information concerning the aborigines. The authors have not confined themselves to objects of interest in the larger towns, as is often the case, but take the reader the length and breadth of the islands. The tourist will find all requisite information; the business man will find something of the activities of the islands that may suggest investment; the spirit of romance that has always hovered over the islands has not been neglected; while accounts of the buccaneers, traditions of Black Beard, Blue Beard, and others are included. The book is profusely illustrated with photographs taken by Mr. de Booy.

IN connection with the review in this issue of the JOURNAL of Dr. Wissler's *The American Indian* we note a review of the book and an appreciation of the author's work in the *American Indian Magazine*. This magazine is the official organ of the Society of American Indians. The society is exactly what its name states—an organization of Indians to promote the education and general progress of the race and to assist in defense against incompetency and dilatory politics in the administration of Indian affairs.

The copy containing this review is a special Sioux number. Early in his anthropological work Dr. Wissler went out among the Sioux of South Dakota where he obtained much of the material which now forms in the American Museum the exhibition relating to the Indians of the Plains. A number of Sioux Indians (notably George Sword and Thomas Tyon) actively assisted him in the work, to whom both the Museum and Dr. Wissler are greatly indebted.

THE recent fire that swept over several hundred square miles of Minnesota forests, destroying $100,000,000 worth of property and killing more than one thousand persons, is a matter to attract national attention even

[1] *Decorative Textiles.* An illustrated book on coverings for furniture, walls and floors, including damasks, brocades and velvets, tapestries, laces, embroideries, chintzes, cretonnes, drapery and furniture trimmings, wall papers, carpets and rugs, tooled and illuminated leathers. By George Leland Hunter. Published by the J. B. Lippincott Company, Philadelphia and London, and the Dean-Hicks Company, Grand Rapids; pp. 458, illustrations 580, and 27 plates in color. 1918.

[2] *The Virgin Islands, Our New Possessions, and the British Islands.* By Theodoor de Booy and John T. Faris. Published by the J. B. Lippincott Company, pp. 287, 5 maps, and 97 illustrations from photographs.

in these times when we have become accustomed to destruction of life and property on a huge scale. This holocaust was apparently the result of negligence on the part of the state legislature, which cut the forest protection appropriation nearly to the vanishing point. Although the state forester announced the presence of slow bog fires in the northern forests, he was unable to obtain labor for extinguishing them. It is to be hoped that Minnesota public opinion will now force the necessary legislative action to prevent a repetition of such catastrophes —of which the present fire is the third instance (Hinckley 1894, Bandette 1910, Duluth 1918).

A RECENT issue of the *Memoirs* of the American Museum [1] contains a notable series of illustrations of the North American species of the genus *Catocala* or "underwing moths," by Wm. Beutenmüller, with additional plates and explanatory text by Dr. Wm. Barnes, of Decatur, Illinois, and his entomological assistant, Dr. J. McDunnough. This memoir is the most elaborate and beautifully illustrated work of the kind that the Museum has issued, covering, as it does, the work of many years and the services of several entomologists. It contains more than 550 illustrations, of which 381 are colored drawings by Mrs. Beutenmüller. The whole series is for the most part the material for a monograph on these moths left unfinished by Mr. Beutenmüller when he withdrew from his curatorship in the American Museum in January, 1912.

THE war has centered attention on what can be gained by coöperation between the scientific men and the government of a country. A noteworthy instance of the willingness on the part of men in governmental positions to coöperate with men of science was illustrated in the summer of 1918 in the West Indies, when the nineteen instructors and graduate students composing the Barbados-Antigua Expedition of the State University of Iowa were entertained in government buildings and provided with laboratory and field facilities. The scientific results of the expedition will be reported upon by Mr. John B. Henderson, of Washington (Mollusca), Dr. Barton W. Evermann, California Academy of Sciences and Pacific Fisheries Society (reef fishes), Dr. W. K. Fisher, Hopkins Marine Station, Stanford University (Asteroidea and Holothuroidea), and Professor C. C. Nutting, State University of Iowa (Hydroidea and Alcyonaria).

THAT disease has not always been a scourge to animal and plant life, but arose some time during the great Coal Period of the earth's geological history is the opinion of Professor Roy L. Moodie, set forth in a recent number of the *Scientific Monthly*. The evidences for the antiquity of disease are limited to such forms as would leave their marks upon fossilized bones and among these Professor Moodie has found a number of pathological conditions closely resembling those resulting from known maladies. The giant reptilians (dinosaurs, etc.) show tuberculous and tumorous degeneration of the bones; among these monsters disease seems to have reached a climax, for after their extinction its evidences are less prominent until the appearance of mammals. Nothing new with regard to pathological structure has been learned nor was this to be expected, although, inasmuch as we know from the evidence of medieval history that diseases become extinct, further study may reveal infirmities hitherto unknown to science. Furthermore, no light is thrown on what part, if any, disease may have played in the blotting out of species, so that we are left in this important question to fall back entirely on historical analogy.

IN connection with the memorial by Professor Charles P. Berkey in the present number of the JOURNAL (page 705), the Editor wishes to call attention to a portrait of the late Charles R. Van Hise, geologist and president of the University of Wisconsin, in the February, 1918, issue (page 94). The reproduction is from a photograph of the bronze bust by the sculptor, the late C. S. Pietro, which was executed for the University of Wisconsin, and was on view in Memorial Hall of the American Museum for several weeks in the spring of 1918, before being sent to its destination. The bronze well portrays the fine intellectual strength of the man.

[1] "Illustrations of the North American Species of the Genus *Catocala* by Wm. Beutenmüller, with Additional Plates and Text," by Wm. Barnes, M.D., and J. McDunnough, Ph.D., *Memoirs* of The American Museum of Natural History, New Series, Vol. III, Part 1.

THE American Forestry Association has inaugurated the plan of planting trees as memorials to our soldiers and sailors who lost their lives in the war. No better monuments to the memory of our fallen heroes could be devised than rows of living trees. The idea is receiving nation-wide commendation, and several specific methods have been suggested, among them the bordering of the great interstate highways. The fact that the now destroyed forests of France are recognized as having saved Paris makes this form of commemoration peculiarly appropriate.

COUNT BEGOUEN, whose discoveries of prehistoric art objects in the caves of southern France are well known, is reported in *Le Figaro* (quoted by *Science*) as having made some additional explorations with his three sons during the latter's furloughs from the front. This time they discovered a series of painted figures. These paintings are among the most ancient records of human art (30,000 years old?) that have ever been found, and in this last instance include the unusual representations of a lion and the human figure. One particularly remarkable silhouette is that of a powerful, thick-necked man with perfectly human limbs but with a caudal appendage like that of the apes.

ABOUT twenty miles south of the great fossil quarry at Agate, Nebraska, there is a peculiar fossil deposit of somewhat later geological age, which has been called the Snake Creek beds. They consist of a series of small pockets in the sand and gravel beds near the surface, full of fossil teeth and bones, mostly fragments, but with many jaws and complete bones and occasional skulls among them. Three-toed horses are the most numerous; many thousands of teeth have been found, hundreds of jaws, and one fairly complete skeleton. A great number of other animals of the Lower Pliocene are represented in the American Museum collections from the pockets, obtained in 1908 and 1916. During this last summer Mr. Albert Thomson has obtained for the Museum an additional collection which includes a few interesting specimens, the best being fine skulls of the long-legged rhinoceros, *Aphelops*, and the rare rodent, *Mylagaulus*. The collection which he has brought back to the Museum will add materially to our knowledge of the mammalian life of the Lower Pliocene.

THE American Museum Handbook Series presents to the public a new volume on *Fishes of the Vicinity of New York City*, by Mr. John T. Nichols. In addition to a key and illustrated descriptions of all the local fishes, the book contains an introduction by Dr. William K. Gregory on "The Structure and Mechanism of Fishes." This handbook will appeal not only to local collectors and anglers but also to everyone interested in the natural history of New York City as found both out-of-doors and in the New York Aquarium and the American Museum.

MR. H. C. RAVEN, of the Smithsonian Institution, who returned to Washington from the island of Celebes on September 28, has gone to Cornell University to continue his studies. Mr. Raven has collected in the East Indies during the last six years more than four thousand mammals and five thousand birds for the National Museum.

MR. ROY W. MINER, of the American Museum of Natural History, and his corps of assistants, Messrs. Show Shimotori, Chris E. Olsen, and Herman Mueller, spent six weeks of the summer of 1918 at the Marine Biological Laboratory, Woods Hole, Massachusetts. There, through the courtesy of that institution, they enjoyed facilities otherwise impossible for obtaining data and sketches for a new Museum group. The group will represent, magnified 625 times, an area of the sea bottom which could be covered by a 1⅝ inch magnifying glass. It is designed to show the natural history and methods of life of a number of minute sea animals, those known as the moss animals and their associates, and one of the ascidians (a "sea squirt"), the latter as a representative of forms closely related to the stock from which it is supposed the vertebrates have sprung.

FISH life at the very edge of rocky coasts, both in the tropical or subtropical Atlantic and the north Pacific, is represented in two new minute groups, each 22 × 13¼ inches, lately placed in one of the cases of the fish hall of the American Museum. Small sculpins in the North superficially resemble blennies and gobies of the Tropics, whereas northern and southern blennies are quite unlike. The southern Atlantic group contains

brightly colored coral reef fishes, the northern Pacific, viviparous surf fishes.

THE Education Act passed by the closing, 1918, parliament of England is in a way an epochal piece of legislation for the United Kingdom. The selection of men for the army has revealed the need for greater attention to the physical well-being of the country's youth so this feature has received special attention. Special provision is also to be made for the physically inferior as it has previously been made for the feeble-minded. All fees are abolished and school attendance is made compulsory between the ages of five and fourteen. Although secondary schools are not established by the Act, their growth is encouraged and the central schools are extended, providing for higher studies than those of the elementary schools. The bill is a recognition of the liberal aspects of education and the place that these have in the welfare of the people. A notable feature of the Act is that it places the control of child labor in the hands of the educational authorities so that there is hope that this evil is finally settled.

To quote from *Nature*, November 7, the measure provides "not only for a fairly adequate training in literature and in science, but also for effective, practical instruction for both eye and hand, as well as for the physical health and training of the child, and that at just the period of his life when he is most susceptible of treatment and of the permanent effect of such training. Few Acts have been subjected to so large a measure of public discussion as the Education Act of 1918, or have won so general an approval. Its chief purpose, whilst providing for the general well-being of the childhood of the nation, so vital a matter in present circumstances, is to give full opportunity for those who are naturally gifted to share in the highest educational advantages which the nation can offer. . . . And there is abundant testimony . . . to the wonderful initiative and intelligent grasp of the young men trained in the elementary schools who, in their scores of thousands, joined the national forces in 1914. The crux of the success . . . lies with the teachers, who must now, whatever the cost, alike in respect of payment, prospects, and pensions, be attracted to the most vital and worthy of the national services."

THE annual report of the Secretary of Agriculture for 1918 reveals the fact that very satisfactory results have come from the farmers' response to the world's unusual demand for food. Although 1918 is not in every respect a record year for production, it is so far above the 1910–14 average that it stands favorable comparison with the four years that have witnessed intensive war cultivation. While the yield of crops is a result of climatic conditions as well as of industry and acreage, and these conditions were very adverse in 1917 and especially for corn in 1918, the production of cereals during these two years has been exceeded only by the record year of 1915. The acreage planted in cereals, tobacco, and cotton in 1918 exceeds by more than five and a half million the acreage of the record year.

With regard to monetary value, the Secretary estimates that the value of all crops for 1918, together with that of all live stock on farms, is somewhere around $24,700,000,000 as compared with $21,325,000,000 for 1917 and $11,700,000,000, the annual average for the five year period 1910–14. This does not mean that the country's wealth has increased to that extent, but rather that the financial returns to farmers have increased proportionally with those to other producers and their purchasing power has kept pace with the general rise of prices.

OWING to the retirement of Mr. Wallace Goold Levison from the *American Mineralogist*, Dr. Edgar T. Wherry, Bureau of Chemistry, Washington, D.C., will assume the duties of editor-in-chief, with the following associate editors: George F. Kunz, president of the New York Mineralogical Club; Herbert P. Whitlock, American Museum of Natural History; Alexander H. Phillips, Princeton University; Waldemar T. Schaller, U. S. Geological Survey; Edward H. Kraus, University of Michigan; Austin F. Rogers, Leland Stanford Junior University; Thomas L. Walker, University of Toronto, Canada; and Samuel G. Gordon, Academy of Natural Sciences, Philadelphia.

A COLLECTION of valuable archæological objects from Oncion, Santo Domingo, has been acquired by the department of anthropology in the American Museum through the gift of Mr. E. J. Valeur, of New York City.

The American Museum of Natural History

Its Work, Membership, and Publications

The American Museum of Natural History was founded and incorporated in 1869 for the purpose of establishing a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects, and to that end, of furnishing popular instruction.

The Museum building is erected and largely maintained by New York City, funds derived from issues of corporate stock providing for the construction of sections from time to time and also for cases, while an annual appropriation is made for heating, lighting, the repair of the building and its general care and supervision.

The Museum is open free to the public every day in the year; on week days from 9 A.M. to 5 P.M., on Sundays from 1 to 5 P.M.

The Museum not only maintains exhibits in anthropology and natural history, including the famous habitat groups, designed especially to interest and instruct the public, but also its library of 70,000 volumes on natural history, ethnology and travel is used by the public as a reference library.

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1917:

Attendance in Exhibition Halls	786,151
Attendance at Lectures	115,802
Lantern Slides Sent out for Use in Schools	63,111
School Children Reached by Nature Study Collections	1,104,456

Membership

For the purchase or collection of specimens and their preparation, for research, publication, and additions to the library, the Museum is dependent on its endowment fund and its friends. The latter contribute either by direct subscriptions or through the fund derived from the dues of Members, and this Membership Fund is of particular importance from the fact that it may be devoted to such purposes as the Trustees may deem most important, including the publication of the JOURNAL. There are now more than four thousand Members of the Museum who are contributing to this work. If you believe that the Museum is doing a useful service to science and to education, the Trustees invite you to lend your support by becoming a Member.

The various Classes of Membership are as follows:

Associate Member (nonresident)	annually	$3
Annual Member	annually	10
Sustaining Member	annually	25
Life Member		100
Fellow		500
Patron		1,000
Associate Benefactor		10,000
Associate Founder		25,000
Benefactor		50,000

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Current copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January

A complimentary copy of the President's Annual Report, giving a complete list of all Members

An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence

Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends

The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs, Bulletin* and *Anthropological Papers,* the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks, Leaflets,* and *General Guide,* edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS[1]

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS
By CLARK WISSLER, PH.D. — Paper, 25 cents; cloth, 50 cents

ANIMALS OF THE PAST
By FREDERIC A. LUCAS, SC.D. — Paper, 35 cents

DINOSAURS
By W. D. MATTHEW, PH.D. — Price, 25 cents

TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION
By ANN E. THOMAS, PH.B. — Price, 10 cents

TREES AND FORESTRY
By MARY CYNTHIA DICKERSON
A new edition in course of preparation.

HEALTH IN WAR AND PEACE
By C.-E. A. WINSLOW, M.S., M.A. — Price, 25 cents

ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA
By HERBERT J. SPINDEN, PH.D. — Cloth. Price, 75 cents

FISHES OF THE VICINITY OF NEW YORK CITY
By J. T. NICHOLS, A.B. — Paper, 50 cents; cloth, 75 cents

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS
By LOUIS P. GRATACAP, A.M. — Price, 5 cents

NORTH AMERICAN RUMINANTS
By J. A. ALLEN, PH.D. — Price, 10 cents

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH
By GEORGE H. PEPPER — Price, 10 cents

THE MUSICAL INSTRUMENTS OF THE INCAS
By CHARLES W. MEAD — Price, 10 cents

THE SAGINAW VALLEY COLLECTION
By HARLAN I. SMITH — Price, 10 cents

PERUVIAN MUMMIES
By CHARLES W. MEAD — Price, 10 cents

[1] Prices net; postage extra

PERUVIAN ART
By Charles W. Mead — Price, 10 cents

SYLLABUS GUIDE TO PUBLIC HEALTH EXHIBITS IN THE AMERICAN MUSEUM OF NATURAL HISTORY
By Lawrence V. Coleman — Price, 10 cents

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS
By Frank M. Chapman, Sc.D. — Price, 25 cents
Second edition issued May, 1916.

THE INDIANS OF MANHATTAN ISLAND AND VICINITY
By Alanson Skinner — Price, 20 cents

PLANT FORMS IN WAX
By E. C. B. Fassett — Price, 10 cents

THE EVOLUTION OF THE HORSE
By W. D. Matthew, Ph.D. — Price, 20 cents

MAMMOTHS AND MASTODONS
By W. D. Matthew, Ph.D. — Price, 10 cents

HOW TO COLLECT AND PRESERVE INSECTS
By Frank E. Lutz, Ph.D. — Price, 10 cents

OUR COMMON BUTTERFLIES
By Frank E. Lutz, Ph.D., and F. E. Watson — Price, 15 cents

THE BIG TREE AND ITS STORY — Price, 10 cents

THE INSECT GALLS OF THE VICINITY OF NEW YORK CITY
By William Beutenmüller — Price, 15 cents

INSECTS AND DISEASE
By C.-E. A. Winslow and Frank E. Lutz — Price, 25 cents

SOME REPRINTS

THE GROUND SLOTH GROUP
By W. D. Matthew, Ph.D. — Price, 5 cents

THE WHARF PILE GROUP
By Roy W. Miner, A.B. — Price, 5 cents

THE SEA WORM GROUP
By Roy W. Miner, A.B. — Price, 10 cents

THE ANCESTRY OF THE EDENTATES
By W. D. Matthew, Ph.D. — Price, 5 cents

THE STORY OF MUSEUM GROUPS
By Frederic A. Lucas, Sc.D. — Price, 10 cents

GENERAL GUIDE TO THE EXHIBITION HALLS

New edition issued January, 1918, illustrated, 136 pages. Price, 25 cents

SOUVENIR STAMP ALBUM
A series of 100 subjects printed from four color plates, each stamp $2\frac{1}{8} \times 3$ inches. Sold in sets of 15 stamps for 10 cents. Album providing space for the entire series including 10 stamps, 15 cents. Album and complete series of 6 sets of stamps, 75 cents; postage, 4 cents.

GUIDE TO THE NATURE TREASURES OF NEW YORK CITY
Price, 75 cents

The purpose of this illustrated guide is to render accessible under one cover an account of the public scientific institutions of Manhattan, the Bronx, and Brooklyn.

THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION, AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

December, 1918

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THE AMERICAN MUSEUM JOURNAL

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Published monthly from October to May, by the American Museum of Natural History, New York, N. Y. Subscription price, $1.50 a year.

Subscriptions should be addressed to the Secretary of the American Museum, 77th St. and Central Park West, New York City.

The Journal is sent to all members of the American Museum as one of the privileges of membership.

Entered as second-class matter February 23, 1917, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

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AND WHO OUT OF THESE WINS THE SPLENDID ULTIMATE TRIUMPH.—*Theodore Roosevelt*